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TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME LXXV

A NEW GENUS AND NEW SPECIES OF AMERICAN LAMPYRINI, AND OTHER NOTES

(COLEOPTERA: LAMPYRIDAE, CANTHARIDAE)

BY JOHN WAGENER GREEN
Easton, Pennsylvania

(Plate I)

Three *Lampyridae* and a mid-western species of *Podabrus* are described as new in this contribution. The *Lampyridae* are from the collection of Ohio State University and were received through the courtesy of Dr. J. N. Knull. The author is indebted for the types of the new *Podabrus* to Dr. F. A. Fenton, of Oklahoma Agricultural and Mechanical College, to Dr. Henry Dietrich, of Cornell University, and to Dr. W. R. Enns, of the University of Missouri.

LAMPYRIDAE

Ellychnia bivulnerus new species (Plate I, fig. 1.)

Dorsal surface black, the central convex part of pronotum orange-red in more than basal half, the red area broadly divided medially into two large longitudinal spots, these not attaining the base Ventral surface black, inner third of hypomera orange-red, sternite 8 of male with a small whitish spot each side near the lateral margin. Length 7.5–8.5 mm.

External structure, vestiture, and sculpture are as in *Ellychnia flavicollis* Lec., differing only in the slightly stouter antennae, in the minute secondary pubescence covering more of the elytral surface and lacking only along the base, and in the ventral surface of the abdomen being smoother and more finely punctate. The ventral surface of the median lobe of the aedeagus is

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entirely corneous, excepting the subapical orifice, the ventro-basal sclerotized processes being represented by lateral enlargements in the usual position of the processes.

Holotype.—Male; Patagonia Mts., Arizona, July 20, 1940, collected by D. J. and J. N. Knull; located in Ohio State University collection.

Paratypes.—ARIZONA: Huachuca Mts., July 20, three males; Patagonia Mts., July 20, one male. Two of the paratypes are in Ohio State University collection, two in collection of author; all were collected by Dr. Knull.

No females of this species have been seen. The whitish lateral spots of sternite 8 have the appearance of being light-producing organs. The resemblance of *Ellychnia bivulnerus* to *Pyropyga fenestralis* Melsh. is rather close, and possibly the two may be found mixed in some collections. The comparatively wide epipleura of *Ellychnia* readily distinguish it from *Pyropyga.*

Micronaspis floridana Green.[1] The allotype of this species has been deposited by Dr. Frank N. Young in the University of Michigan Museum of Zoology, Ann Arbor, Michigan.

With *flavicollis* and *simplex, bivulnerus* constitutes a division of *Ellychnia* characterized by the longer and finer suberect elytral pubescence, and by the more conspicuous minute secondary pubescence covering most of the elytral surface. The two complexes now known as *corrusca* and *californica* have the primary elytral pubescence coarser and decumbent, and the secondary pubescence excessively minute and difficult to perceive, and generally confined to the elytral flanks.

Pleotomodes knulli new species

Pronotum dark piceous, the broad explanate borders, and narrowly along the base, pale testaceous yellow; scutellum pale; elytra piceous brown with narrow pale sutural, apical, and lateral borders, the lateral wider, the sutural enveloping the scutellum; antennae dark piceous; ventral surface and legs pale testaceous yellow. Length 7–8 mm.

Very similar to *Pleotomodes needhami* Green,[2] differing as follows. Form a little broader, somewhat attenuate posteriorly. Eyes extremely large, contiguous beneath, individual eye facets isolated, separated by a distance equal to one-fifth or one-sixth of their diameters. Second joint of antennae longer about twice as wide as long. Pronotum more transverse, three-tenths wider than long, broadly rounded in front; disk more strongly convex, the entire convexity dark piceous; anterior vitreous spots smaller and less evident. Pubescence of upper surface shorter and denser, similar throughout, decumbent, not more erect on elytra.

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[1] Trans. Amer. Ent. Soc., 1948, LXXIV, p. 63.

[2] Trans. Amer. Ent. Soc., 1948, LXXIV, p. 65.

Holotype.—Male; Dade County, Florida, May 12, 1939, collected by D. J. and J. N. Knull; located in Ohio State University collection.

Paratype.—Male; same data and location as holotype.

Amplifying the distinctions given above, it is noted that in *P. needhami* the form is parallel, not narrowed posteriorly; the eyes are distinctly separated beneath and have their individual facets more convex and densely crowded, being virtually contiguous; and the pronotal piceous spot does not occupy all of the central convex area, and is more or less divided except in front. A very conspicuous difference between the two species is afforded by the longer, sparser, and nearly erect elytral pubescence of *needhami*. The present species is named in honor of Dr. J. N. Knull.

PARAPHAUSIS new genus

MALE.—Body elongate oval, sides subparallel; integuments subgranulate. Head, when retracted, completely covered by the pronotum, its ventral surface rather abruptly declivous (as viewed from below) behind the eyes, the occipital foramen not advancing as far as the transverse rim of the declivity. Eyes not enlarged, widely separated above and beneath. Antennae approximate, short and stout, compact, cylindrical, not compressed; 11-jointed, second joint short, third subequal to the following, terminal joint with a minute flat circular appendix. Clypeus semicircular, the suture distinct. Mandibles very small, nearly straight, distant, subconical, the tips blunt. Maxillary palpi large and stout, compact, tip of fourth joint testaceous and having the appearance of a terminal appendix; labial palpi minute (?).

Pronotum semi-elliptic, anterior angles obliterated, posterior angles rectangular, narrowly rounded; disk without anterior vitreous spots; sides broadly explanate. Hypomera open anteriorly, inner margin not sinuate.

Elytra elongate, not extending to abdominal apex, without discal costae; sides declivous at the humeri, thence narrowly subexplanate; vestiture dual; epipleura obliterated behind the usual wider basal part.

Abdomen with eight visible sternites, without light organs, spiracles dorsal; apical angles of sternites not produced; tergites not visible from below at the sides, except tergite 7 which is slightly wider and considerably longer than its sternite; sternite 8 with a median process, sternite 9 deeply notched, pygidium truncate.

Legs short and stout, compressed; tibiae apparently without spurs; fifth tarsal joint extending for most of its length beyond lobes of fourth; claws simple.

Female unknown.

GENOTYPE: *Paraphausis eximius* new species.

Paraphausis is most nearly related to *Phausis,* from which it differs essentially in the structure of the mandibles and in lacking the two anterior vitreous spots of the pronotum. The mandibles of *Phausis* are well developed, arcuate and decussate, with the tips acute.

Paraphausis eximius new species (Plate I, fig. 2.)

Piceous black, pronotum except explanate sides and broad anterior border, scutellum, maxillae except palpi, underside of prothorax and mesothorax except fuscous borders of the former, pygidium, and abdominal sternites 8 and 9 fulvous. Surface feebly shining, the elytra more opaque; pubescence fine and short, decumbent, rather sparse throughout. Length 4–4.5 mm.

MALE.—Head transverse; eyes prominent, rather small, separated beneath by a distance one-third greater than their length, more distant above, individual facets convex and very narrowly separated. Antennae slightly longer than pronotum, first joint wider than long, second strongly transverse, third triangular, joints 4 to 11 quadrate, subequal, tapering only feebly to apex, terminal appendix testaceous. Terminal joint of maxillary palpi short, about as long as wide, widest at base.

Pronotum one-fifth wider than long, lateral margins subparallel or feebly converging from the hind angles, base very shallowly emarginate in a broad circular arc; fulvous median area shining, sparsely granulate-punctate, subalutaceous each side; sides abruptly reflexed, these and the dusky anterior border densely and coarsely punctate, the punctures circular, interstices irregularly roughened.

Elytra three times as long as pronotum, reaching to abdominal tergite 7, conjointly one-half as wide as long, at middle about one-fourth wider than pronotum; fine surface rugulosity forming dense and shallow punctiform impressions, setigerous punctures of the intervals finely granulate; minute secondary pubescence evenly distributed, lacking along the base.

Abdomen with ventral surface rather closely granulate, intervening surface shining, minutely and densely punctulate; sternite 8 not emarginate, with a blunt subtriangular median process a little longer than wide; sternite 9 with a deep and narrow triangular apical notch.

Holotype.—Male; Huachuca Mts., Arizona, July 20, 1937, collected by D. J. and J. N. Knull; located in Ohio State University collection.

Paratype.—Male; Miller Canyon, Huachuca Mts., Arizona, July 21, collected by H. A. Wenzel; located in Ohio State University collection.

The labial palpi are not clearly visible in either of the two specimens available. In the holotype no trace of labial palpi could be detected. In the paratype there are obscurely visible between the maxillae two minute appendages of which the terminal joint appears to be compressed, and widest at the truncate apex. The partly exposed genitalia are of the type usually found in this part of the lampyrid series. The median lobe extends beyond the lateral lobes, is vertically compressed, and is bluntly rounded at apex. The lateral lobes are arcuately narrowed to apex, each terminating in a small and abruptly limited subglobular knob.

CANTHARIDAE

Podabrus infumatus new species (Plate I, fig. 3.)

Pale fulvous, antennae except base of first joint, tips of palpi, femora at apex, tibiae, and tarsi black; disk of elytra more or less dilute fuscous in the male, black in the female with the base and margins pale, the sutural narrowly, the lateral pale margin expanding basally to include the humeri; ventral surface of abdomen pale or somewhat dusky medially, largely dark in the female. Length 10–13.5 mm.

MALE.—Eyes moderately large, head one-fifth wider than pronotum, shining, without alutaceous sculpture, densely and finely punctate posteriorly; epicranium beneath similarly but less densely punctate, nearly smooth in front and medially. Antennae slender, two-thirds as long as the body, vestiture unmodified, second joint three-fourths as long as third, median joints about three times as long as wide.

Pronotum one-fourth wider than long, widest at middle, sides subparallel, anterior angles broadly rounded, hind angles subrectangular, not prominent (dentiform in paratype); surface shining, without alutaceous sculpture, very sparsely and finely punctate, the punctures coarser and denser anteriorly and on the rather prominent basal callosities, median line feebly indicated; sides rather broadly explanate, reflexed in basal third, the hind angles strongly concave.

Elytra finely and densely rugulose, smoother at base; pubescence moderately dense, short, much inclined, fulvous.

Abdomen feebly shining, minute secondary pubescence dense throughout; sternite 7 not membranous medially, apex of sternite 8 broadly emarginate in a circular arc.

Legs long and slender; vestiture of femora short and decumbent, of tibiae longer and more erect, somewhat bristling on front and middle tibiae; underside of front femora near apex of trochanter with a denser patch of longer erect hairs having their tips curved; anterior tibiae straight, not broader apically; metacoxae not sexually modified; claws acutely toothed, the protarsal more narrowly cleft and with the tooth longer. Dorsal plate of aedeagus glabrous above, beneath with long erect hairs throughout, these extending posteriorly in the form of an apical fringe which is interrupted only at the bottom of the somewhat variable emargination.

FEMALE.—Differs from the male in having the eyes smaller, the head not as wide as the pronotum; the antennae shorter, one-half as long as the body, with the second joint only slightly shorter than the third; elytral pubescence darker on the disk, fulvous on the pale margins; abdominal sternite 8 with a very small triangular apical notch; vestiture of legs unmodified, shorter and more inclined on the tibiae; claws similar throughout, widely cleft, the tooth blunt and one-half as long as the apical part.

Holotype.—Male; La Flore County, Oklahoma, April 30, 1934, collected by C. A. Sooter; located in Cornell University collection, type number 2479.

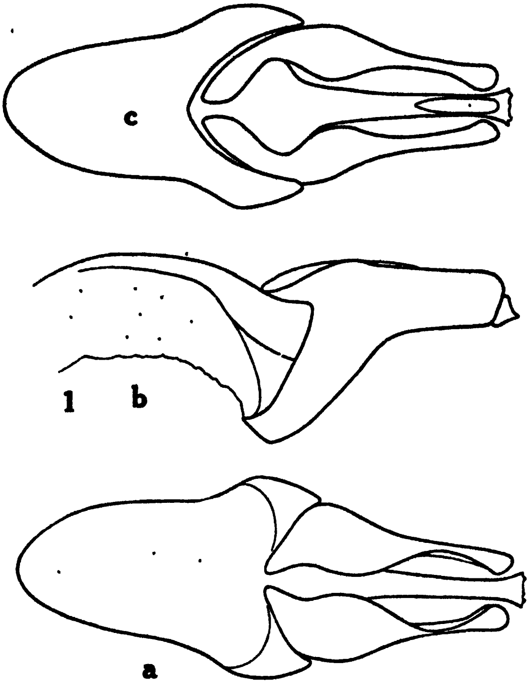
Allotype.—Female; Gravois Mills, Missouri, June 11, 1939, collected by W. R. Enns; located in author's collection.

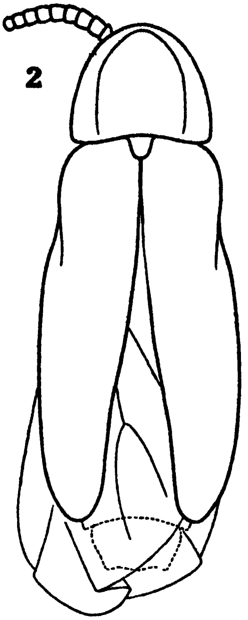
Paratype.—Male; Spavinaw, Oklahoma, May 6, 1934, collected by A. E. Pritchard; located in author's collection.

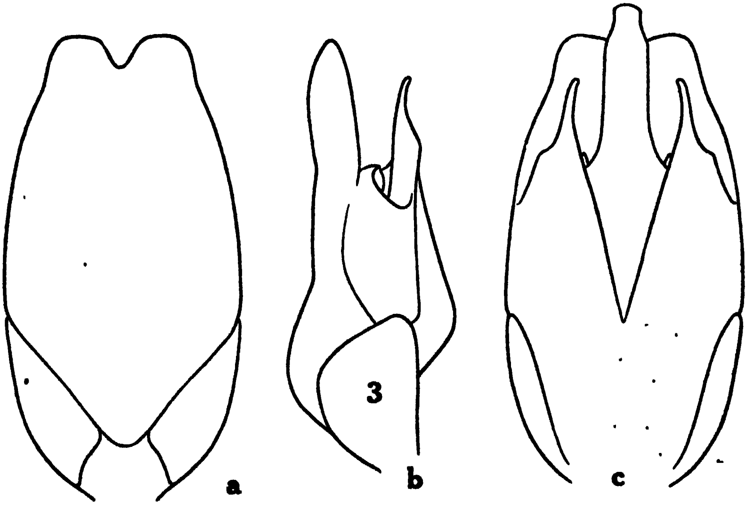
The normal color of the elytra of this species is perhaps not adequately indicated by the material at hand. In the holotype the elytra are almost entirely fulvous, only faintly darker toward apex. In the male paratype the elytral infuscation is much more evident, extending from near apex two-thirds or more toward base, but not attaining either the lateral or sutural margins. The elytra of the female allotype, as described in the first paragraph, are colored very nearly as in *Podabrus falli*, near which species *infumatus* should stand in our list. The former differs from *infumatus* in its entirely pale legs and antennae, and in the male genitalia.

EXPLANATION OF FIGURES

The letters a, b, and c signify, respectively, dorsal, lateral, and ventral aspects. Fig. 1.—*Ellychnia bivulnerus* new species, male genitalia. Patagonia Mts., Arizona, VII-20-40, D. J. and J. N. Knull. Fig. 2.—*Paraphausis eximius* new species. Huachuca Mts., Arizona, VII-20-37, D. J. and J. N. Knull. Fig. 3.—*Podabrus infumatus* new species, male genitalia. La Flore County, Oklahoma, IV-30-34, C. A. Sooter.







GREEN--NEW GENUS OF LAMPYRINI

THE NEARCTIC SPECIES OF THE GENUS PERICLISTA[1]

(HYMENOPTERA: TENTHREDINIDAE)

L. J. STANNARD, JR.

State Natural History Survey
Urbana, Illinois

(Plates II to V and text-figure)

The sawfly genus *Periclista* Konow, of the subfamily Blennocampinae, is predominately Holarctic in distribution. Eighteen of these species are known from North America; a dozen or more species occur in the Palaearctic region; and one other from South America has been assigned to this genus. Apparently they subsist on oak and hickory leaves in their developmental stages, and only forests that contain these trees provide suitable habitats within their ranges. But even in these woodlands they tend to be inconspicuous, mainly because of the short duration of their active life, their extremely local distribution, and yearly fluctuations in numbers.

Norton (1867–1869) published the first key to the North American fauna in his *Catalogue of the Tenthredinidae and Uroceridae of North America.* All of the species were then included under the genus *Selandria* Leach, tribe 2, subtribe A (*Monophadnus*) Hartig. After the erection of the genus *Periclista* by Konow (1886), the next regional key was constructed by Dyar (1898) in which the species were divided into the genera *Periclista* and *Isodyctium* Ashmead. Meanwhile, Dalla Torre (1894) listed five Nearctic species under *Monophadnus,* two under *Blennocampa,* and one under *Phymatocera*. Konow (1905) in the *Genera Insectorum* included thirteen species of *Periclista* for the world, but omitted Dyar's species. Finally, MacGillivray (1916) devised a key to the Eastern North American species and disregarded Konow's proposition that *Isodyctium* was a synonym of *Periclista*. New species subsequently described were related to their nearest ally according to the conceptions of their respective authors but no other key to the species was advanced.

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[1] Contribution No. 286 from the Entomological Laboratories of the University of Illinois in cooperation with the Illinois State Natural History Survey. This revision is an elaboration of a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Entomology in the Graduate School of the University of Illinois, 1947.

That considerably more names have been proposed than the apparent total number of valid species is an indication of the variability of those parts of the anatomy previously selected as diagnostic. A search for more definite characters revealed that the male and female genitalia varied markedly in shape interspecifically and could, therefore, provide positive points for identification and show phylogenetic groupings. Genitalic structures, as used herein, were studied from preparations made in accordance with the methods recommended by Ross (1945). Further specific characterizations of the species can be derived from the larval forms, but, since many of the immature stages are still unknown, a comprehensive report of the larvae must be deferred to the future.

Approximately three hundred fifty specimens were assembled for this study. Included in the consulted collections were most of the North American types with the exception of *Periclista mutabilis* Konow, *Selandria albicollis* Norton, and *Selandria marginicollis* Norton. Material identified by Dyar as conspecific with *albicollis* was examined in place of the probably missing type.

I gratefully acknowledge my obligations to my advisors, Dr. Wm. P. Hayes and Dr. H. H. Ross, for the stimulating guidance they gave me. Furthermore, I am indebted to the officers of the following museums or institutions and to the following individuals for the loan of their material and for the facilities they so generously made available: Academy of Natural Sciences of Philadelphia (ANSP); California Academy of Sciences (CAS); Cornell University (CU); Hasting's Natural History Reservation, Monterey, California (HNHR); Illinois State Natural History Survey (INHS); H. E. Jaques Collection, Mount Pleasant, Iowa (HEJ); Kansas State College (KSC); MacGillivray Collection, University of Illinois (MCUI); W. W. Middlekauff Collection, Univer-

sity of California (MIDD); Mississippi Agricultural College (MAC); Museum of Comparative Zoology (MCZ); Pennsylvania State College (PSC); and the United States National Museum (USNM).

PERICLISTA Konow

In North America, the genus *Periclista* can be recognized from other members of the subfamily Blennocampinae by the characters set forth by Ross (1937). These distinguishing characteristics are: the upcurved stub of veins 2A and 3A in the hind wing, the parallel veins of M and lm-cu of the forewings, the usually cleft tarsal claws with the inner tooth directly below but well separated from the outer one, the presence of pulvilli on all of the tarsal segments, the absence of a prepectus, the filiform antennae, the minute indistinct punctures of the mesopleurae, and the absence of a trough-like groove under the lateral margins of the eyes.

Previously, considerable attention was given, in the definition of the species, to the contours of the head, especially the shape and limits of the ocellar basin; the position of the antennal and post-ocellar furrows; and the width of the post-ocellar area. Unfortunately, reference to these characters not only would require a collection of named species for comparison, but also these points are subject to individual variation. Color patterns in general are susceptible to variation even within one population. Females in this genus and in some closely related genera show a similar outline in the shape of the ovipositor sheath. It is not surprising, therefore, to find that the length and profile of the sheath tip of many of the species of *Periclista* merge in appearance with one another. Usually the sheath of *Periclista* is pointed but the point is not spurlike as in the genus *Ardis*.

Most of the known and associated larvae were reared by Dyar (1898) and Middleton (1922). The evidence of their studies supplemented by MacGillivray's report (1913) point out that certain distinctive behavior patterns are sometimes demonstrated by the species. These traits may add other characteristics for their recognition.

Basic genitalic patterns indicate that the genus *Periclista* is composed of at least two subgenera. One of these (*Neocharactus*) is represented in North America by four species, all of which are easily recognized. The other subgenus (*Periclista*) contains fourteen Nearctic species that can be grouped into three well-marked complexes. Species within each of these complexes are more similar to each other point by point than are the species of the subgenus *Neocharactus.* As a result, species of *Periclista* s. str. require more detailed examinations before their identity can be ascertained.

The *Lineolata* complex is the most compact of all the groups and very little in the way of marked characters is evident. Furthermore, the West Coast representatives are remarkably similar to the European species, *P. lineolata* (Klug). An inference that *lineolata* or its prototype entered or emerged from the Western Hemisphere by way of the West Coast could be implied from the several species of the *Lineolata* group still resident in the West; from the vast range of *lineolata* itself, which according to Konow (1907) is from southern Europe to Siberia and could, therefore, have been linked with North America in the near past; and from the morphological structures of the western *lineolata*-like species that are intermediate between *lineolata* and the eastern North American forms. At the present, the eastern species of the *Lineolata* complex are isolated from their western allies by the barrier of the Great Plains unless there is a mergence in the oak forests of Mexico.

The complexes *Californica* and *Melanocephala* are composed of more distinct forms. Species of the *Melanocephala* complex are in most cases eastern North American in distribution, whereas the *Californica* species are limited to the West.

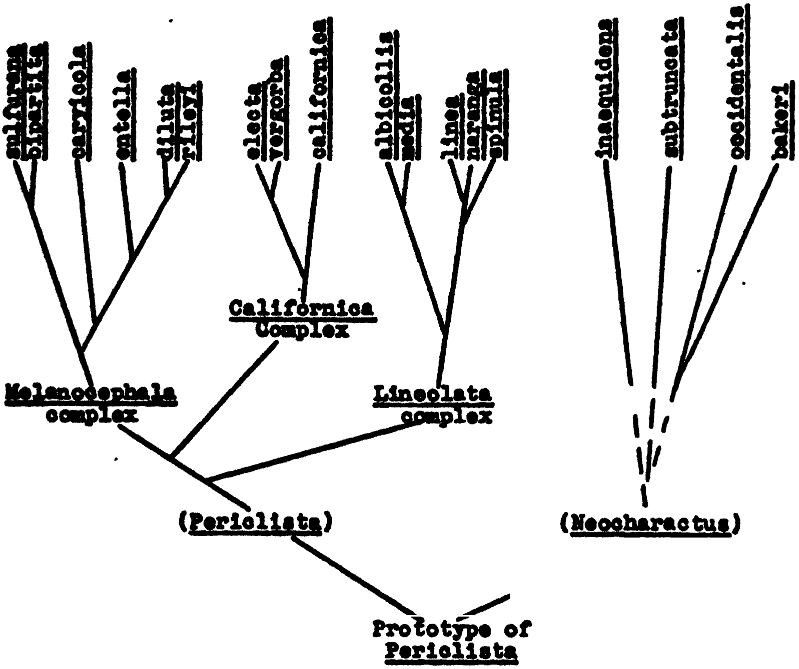
In order to illustrate graphically the probable lines of development of the species in North America, the accompanying phylogenetic tree has been constructed.

Key to the Species

1. Females; venter of last abdominal segments split by a sheath containing a sawlike ovipositor..................................2
   Males; venter of last abdominal segments entire................17
2. Lancet without ctenidia (ct), saw moderately or weakly sclerotized and with about 25 serrulae (se) bearing teeth, figs. 2, 6, 9; 9th abdominal segment moderate in size, usually covered by 8th segment dorsally (subgenus *Periclista*) 3

Ctenidia along sutures of lancet, saw heavily sclerotized and with about 10 serrulae bearing teeth, figs. 12–15; 9th abdominal segment enlarged ventrally, and well exposed dorsally (subgenus *Neocharactus*)..14

3. Dorsal membrane (dm) of saw fringed with setae for most of length of lancet, fig. 9; dorsum of lance toothed for at least half its length, fig. 8; anal cell of hind wing always with a petiolate vein (*Lineolata* complex)..4



Text-fig. 1.—Phylogenetic tree of North American species of *Periclista*.

Portion of dorsal membrane of saw fringed with setae noticeable only along its apical third, figs. 2, 6; dorsum of lance flat or toothed at extreme apex, figs. 1, 5; anal cell of hind wing petiolate, subpetiolate, or petiole vein lacking..7

4. Malar space narrow, varying from a line to barely more than the width of the anterior tibial spur..5

Malar space wide, usually 2 to 3 times width of the anterior tibial spur..6

5. General body color orange; small in size (av. 4.5 mm.)....**naranga**

General body color black, at least head and parts of thorax; larger (av. 6.5 mm.)..**linea**

6. Clypeus sinuate to slightly emarginate, most often apical portion pale.......**media**

   Clypeus moderately incised, apparently more deeply punctured, usually black.......**albicollis**

7. Each serrula with 5 or 6 fine ventral teeth, figs. 3, 4; petiole vein of anal cell of hind wing, if present, less than one-half as long as the width of the anal cell (*Melanocephala* complex).......8

   Each serrula with 10 to 12 fine teeth, fig. 7; petiole of anal cell of hind wing at least as long as width of cell (*Californica* complex)..12

8. Anterior margin of serrula with only one sub-basal tooth, fig. 3; entire margin of clypeus flat.......9

   Anterior margin of serrula with several sub-basal teeth, fig. 4; clypeus depressed at median portion of margin.......11

9. Sheath produced into a pointed tip, fig. 39; most of head and thorax black.......**caryicola**

   Sheath truncate at tip, fig. 40; general body color orange.......10

10. Color uniformly yellow around eyes and most of head.......**diluta**

    Inner margins of eyes with pale yellow orbital line, front of head black.......**rileyi**

11. Sub-basal teeth extending up on saw, fig. 4; general body color orange.......**sulfurana**

    Sub-basal teeth below ventral margin of saw; large areas of black on head and thorax.......**bipartita**

12. Eyes bordered by yellow line; very deep groove between antennae; head globular.......**californica**

    Head black; area between antennae not greatly sunken; tendency for eyes to converge ventrally, fig. 38.......13

13. Dorsum of abdomen black.......**electa**

    Dorsum of abdomen reddish-orange.......**vergorba**

14. Serrula without sub-basal tooth (sb), teeth absent from margin of lancet; sutures incomplete from base to mid portion of lancet, fig. 15.......**bakeri**

    Serrula with at least one sub-basal tooth (sb); lancet with conspicuous teeth along margin; most of the sutures complete, figs. 12–14.......15

15. Sub-basal teeth several in number, fig. 12.......**subtruncata**

    Only one sub-basal tooth per serrula, figs. 13, 14.......16

16. Serrula with teeth along entire length, the distal ones underlying sub-basal tooth of succeeding segment, fig. 13.......**occidentalis**

    Relatively few teeth on serrula, and these on basal margins, fig. 14.......**inaequidens**

17. Hind wings enclosed by a peripheral vein (subgenus *Periclista*)...18

    Outer cells of hind wings open (subgenus *Neocharactus*).......27

18. Harpes (h) gradually tapering from apex to base, at most with a weak bulge along the median portion of the inner margin, figs. 19, 20; parapenis (pp) greatly extended above its point of union, figs. 21, 24, 26.......19

Harpes with median inner marginal angle markedly extended, figs. 16–18; parapenis just slightly extended above point of union, figs. 16, 25 (*Melanocephala* complex)............................23

19. Valvispina (va) elongate, covering at least the width of the penis valve, figs. 30, 31 (*Lineolata* complex)........................20

Valvispina spurlike, never longer than one-half the width of the penis valve, figs. 32, 33 (*Californica* complex)................26

20. Base of valvispina expanded into a sharp point or spine, fig. 30. **spicula**

Base of valvispina not extended beyond abossicular (A) margin, fig. 31..21

21. Malar space narrow, varying from a line to rarely wider than width of anterior tibial spur.................................**linea**

Malar space broad, 2 to 3 times wider than width of anterior tibial spur..22

22. Clypeus sinuate to weakly emarginate, usually pale..........**media**

Clypeus moderately emarginate, black...................**albicollis**

23. Inner margin of harpes long, its angle formed near its base, fig. 18; parapenis extended anteriorly, fig. 25........................24

Inner margin of harpes shorter, its angle formed nearer the middle, figs. 16, 17; parapenis flat or nearly so anteriorly, fig. 16; median part of margin of clypeus depressed slightly.................25

24. Clypeus usually light in color, not distinctly emarginate...**caryicola**

Clypeus deeply emarginate, black........................**entella**

25. Basal inner margin of harpes with two oblique sides, fig. 16; general body color orange..............................**sulfurana**

Basal inner margin of harpes straight, fig. 17; large areas of black on head and thorax..................................**bipartita**

26. Head with yellow orbital lines; anterior margin of parapenis nearly straight, fig. 26...................................**californica**

Head black; anterior margin of parapenis slightly produced in middle, fig. 21..**electa**

27. Apex of penis valve (pv) drawn out into a point, figs. 34, 36.....28

Apex of penis valve rounded, fig. 35..................**subtruncata**

28. Ental thickenings of penis valve extended into the apical half, fig. 34..**bakeri**

Ental thickenings of penis valve confined to the basal portion, fig. 36...**occidentalis**

Subgenus **Periclista** Konow

1886. *Periclista* Konow, Wien. Ent. Zeit., v: 186. Genotype by subsequent designation of Rohwer (1911)—[*Tenthredo* (*Allantus*) *lineolata* Klug 1818)].

1895. *Mogerus* MacGillivray, Can. Ent., xxv: 281. Rejected by Ashmead (in Dyar, 1898).

1898. *Isodyctium* Ashmead (in Dyar), Journ. N. Y. Ent. Soc., VI: 127. Genotype by original designation—*Mogerus caryicolus* Dyar. Synonymized by Konow (1905).

1914. *Apericlista* Enslin, Deut. Ent. Zeit., 265. Genotype by original designation—*Tenthredo albipennis* Zaddach. Synonymized by Ross (1937).

The diagnostic characteristics pertaining to this subgenus are as follows: In the female, (1) the ninth abdominal sternite is not as enlarged as in the subgenus *Neocharactus;* (2) the ninth abdominal tergite is usually covered by the eighth segment; (3) and the saw is weakly sclerotized, with about 25 serrulae that bear teeth on their ventral surface, and without ctenidia along the sutures. The male can be recognized by the presence of a peripheral vein in the hind wing.

The first described species of *Periclista* was *Tenthredo melanocephala* Fabricius (1798) but it was not until almost a century later that this genus was separately recognized. Konow proposed the name *Periclista* in 1886, listing at that time five European species and one variety. His name, *Periclista,* was a descriptive one from the Greek meaning "closed around." This word refers to the peripheral vein in the hind wing of the males which borders and encloses the veins of the wing, and it is one of the main features in differentiating *Periclista* s. str. from the subgenus *Neocharactus.*

Periclista, in spelling, was believed by MacGillivray to resemble the cynipid genus *Periclistus* too closely; he therefore proposed the name *Mogerus* in 1895 as a substitution. Changing of the generic name in this manner was not justified and Ashmead (in Dyar, 1898) dropped *Mogerus* in favor of the original *Periclista.*

A variable condition of the venation of the hind wings of the female exists equally in both the subgenera *Periclista* and *Neocharactus.* The anal cell of the hind wing formed by vein *1A* and *2A* either meets just at the junction of *cu-a* or else is some distance away from *cu-a* and instead is joined to a petiolate vein, an extension of *1A.* Ashmead (in Dyar, 1898), in analyzing this condition, divided the genus into two genera: *Isodyctium* Ashmead for those species in which the anal cell lacked the petiole vein, and *Periclista* Konow for the species which possessed a petiolate vein leading from the anal cell. Konow (1905) disagreed with this concept by synonymizing *Isodyctium* with *Periclista,* and Rohwer

(1917) again placed *Isodyctium* as a synonym of *Periclista* without reference to Konow's previous action or Enslin's (1914) acceptance of the change.

Malaise (1933) placed *Hypargyricus* MacGillivray in synonymy with *Periclista.* This designation was subsequently corrected by Ross (1937) and *Hypargyricus* is now considered a synonym of *Phymatocera* Dahlbom.

The North American and European species of this subgenus, whose life histories are known, feed as larvae on the leaves of *Quercus* and *Carya.*

Lineolata Complex

One of the most singular characters of this group lies in the shape of the saw of the female genitalia. The same general pattern of the lance and lancet is manifest in every one of the included species known, and while this condition permits the easy grouping of the species, it does not offer any satisfactory specific differences. The dorsum of the lance is produced at the base of each suture into a minute but distinct spine, fig. 8. The lancet bears on its ventral surface about twenty-five groups of teeth, one set of four to eight teeth to each serrula. The wide dorsal membrane, extended for most of the saw length, and the dorsal position of the pores are found only in the lancet of the *Lineolata* complex species, fig. 9. Both the lance and lancet are moderately sclerotized. The base of the scales on the lancet are minute, yet the elongate, hairlike tip is conspicuous, more so than in the *Melanocephala* complex.

The male genitalia, which also follow a general form, further corroborate the proposed common origin of these species. Except for slight variations, the harpes of the male genitalia is normally extended basally into a broad truncate lobe as in fig. 19. Some males of *linea* are so lightly sclerotized in the region of the basal lobe of the harpes that this structure seems more nearly like that found in the *Californica* complex. Both the *Melanocephala* and *Lineolata* groups show a similar outline in the penis valve, but the *Lineolata* complex species have two marked additions to this structure; the broad elongate valvispina and a group of scales on the upper ossicular margin to form a faint lip. One unique specimen from California was found to have an extension of the valvispina into a point on its abossicular margin and is described here as a new species, *Periclista spicula.*

Variations of the parapenis were noted but no satisfactory divisions based on this part of the genitalia could be formulated. The contours of the head, the shape and size of the post-tergite and first abdominal acrotergite, certain elements of color, and size are subject to much individual variation. An exception to color was made for the new species, *naranga,* for the reason that no intergrades are known and that color does give a point for its recognition.

Studies on the biology of the eastern North American species were made by Dyar (1898), Rohwer (1912 and 1917), and Middleton (1922). The leaves of oak furnish food for the larvae whose feeding habits are solitary in all of the stages. The biology of the western species has not yet been considered.

Periclista media (Norton) (Figs. 8, 22.)

1864. *Selandria medius* Norton, Proc. Ent. Soc., III: 9. (♂, ♀.) [Type No. 10345, ANSP.]

1867. *Selandria (Monophadnus) medius* Norton; Norton, Trans. Am. Ent. Soc., 1867–1869, p. 112. Redescription.

1880. *Selandria (Blennocampa) floridana* Cresson, Trans. Am. Ent. Soc., VIII: 12. (♂.) [Type No. 192, ANSP.] New synonymy.

1882. *Monophadnus medius* (Norton); Kirby, List Hymen. Brit. Mus., I: 176.

1898. *Periclista media* (Norton); Dyar, Journ. N. Y. Ent. Soc., VI: 132–133. Description of larvae. [Deposited in USNM.]

1898. *Periclista purpuridorsum* Dyar, Journ. N. Y. Ent. Soc., VI: 129–130. (♂, ♀, larvae.) [Types in USNM.] New synonymy.

1908. *Pareophora floridana* (Cresson); MacGillivray, Can. Ent., XL: 289.

1908. *Periclista confusa* MacGillivray, Can. Ent., XL: 291; (♀.) [Type in MCUI.] New synonymy.

1917. *Periclista similaris* Rohwer, Proc. U. S. N. M., LIII (2195): 155–156. (♀.) [Type in USNM, Cat. No. 11363.] New synonymy.

1922. *Periclista similaris* Rohwer; Middleton, Proc. U. S. N. M., LXI (2442): 4–6. Description of larvae. [Deposited in USNM, Hopk. U. S. No. 11363.]

The genitalia of this species align it with the other members of the *Lineolata* complex. The wide malar space separates *media* from the West Coast species, and it can be distinguished from *albicollis* on the shape and color of the clypeus, if the two species are compared.

Female.—Average length 5.7 mm. Color generally black; most of clypeus, labrum, collar in part, tegulae, and posterior margins of the segments of the abdomen, yellow to white; frequently the lobes of the dorsum of the thorax, the mesoepisternum, and the 9th and 10th sternites of the abdomen are chestnut; legs, at least beyond bases of the femora, yellow-brown.

Malar space broad, 2 to 3 times as wide as width of anterior tibial spur; clypeus lightly punctate, sinuate to slightly emarginate, with apical margin weakly sloping and often with puckered appearance; anal cell of hind wing with petiolate vein; genitalia as in figs. 8, 9, 10.

Male.—Average length, 4.9 mm. Usually darker and smaller than female; hind wing enclosed by a peripheral vein; genitalia as in figs. 19, 22, 31.

Host.—*Quercus alba* (Dyar, 1898; Rohwer, 1917; Middleton, 1922).

The larval studies of *Periclista similaris* by Middleton (1922) suggest that *similaris* has more points in common with *purpuridorsum* and thus *media* than it does with *albicollis*. In the larval descriptions of *similaris, purpuridorsum,* and *media,* it is emphasized that the prepupae are spineless, whereas the prepupae of *albicollis* are tuberculate. Color deviations are the only reported differences in the reared larvae of the *media* variants. A geographical race occurs in Florida, represented by the types of *floridana,* in which the malar space and general size are smaller, the color is darker, and occasionally the inner tooth of the tarsal claw is lacking.

When Norton described *media,* he listed a male and a female as cotypes. Of these two, Cresson (1928), selected the female to be the holotype, and by this action preserved the name *media* for *Periclista* because the male "paratype" proved to be a misidentification of a species belonging to *Blennocampa.*

Distribution Records.—Specimens examined 28; 6♂, 22♀.

Florida: 2♂; Haulover; March 12; (C. V. Riley); [types of *floridana,* ANSP]. Illinois: 1♀; Carlinville; April 27, 1895; (Charles Robertson); [INHS]. 1♀; Charleston; April 27, 1932; (H. H. Ross); [INHS]. 1♀; Dubois; April 24, 1914; [INHS]. 1♂; Herod; May 1, 1926; (Auden & Frison); [INHS]. Manitoba: 1♀; Aweme; May 16, 1927; oak; (R. D. Bird); [INHS]. Massachusetts: 1♀; Ellis; May 11, 1909; [MCZ]. New Jersey: 1♀; "New Jersey"; [type of *media,* ANSP]. 1♀; High Point; May 1, 1938; (H. D. Dietrich); [INHS]. 1♀; Fort Lee; May; reared from white oak; (H. G. Dyar); [USNM]. New York: 1♂, 1♀; "Bedford Park, Bellport, Bronx Park, Brookhaven, Pelham Manor, Van Cortlandt Park, and Yaphank, Long Island"; May; reared from white oak; (H. G. Dyar); [USNM]. 1♂, 1♀; Bellport and Pelham Manor, Long

Island; May; reared from white oak; (H. G. Dyar); [types of *purpuridorsum*, USNM]. 2 ♀; Ithaca, Cornell U. Exp.; April 26, 1892; [types of *confusa*, MCUI]. 2 ♀; Ithaca, May 2–8, 1913, 1915; [COR]. 2 ♀; Ithaca, May 9–June 4, 1940; (M. Middlekauff); [MIDD]. 1 ♀; Sea Cliff, Long Island; May; (N. Banks); [MCZ]. PENNSYLVANIA: 1 ♀; Charter Oak; May 7, 1914, reared; (T. E. Snyder); [type of *similaris*, USNM]. 1 ♀; Barrens (State College); May 5, 1946; (Stannard); [PSC]. VIRGINIA: 1 ♀; Dayton; April 30, 1933; (H. C. Will); [PSC]. WASHINGTON, D. C.: 1 ♀; May; reared from white oak; (H. G. Dyar); [paratype of *purpuridorsum*, USNM]. WISCONSIN: 1 ♂; Madison; May 13, 1917; (Chas. L. Fishe); [INHS].

Periclista albicollis (Norton) (Fig. 23.)

1872. *Selandria albicollis* Norton, Trans. Am. Ent. Soc., IV: 85. (♂.) Location of type unknown.

1882. *Phymatocera albicollis* (Norton); Kirby, List Brit. Mus., I: 165.

1898. *Periclista albicollis* (Norton); Dyar, Journ. N. Y. Ent. Soc., VI: 130–131. Description of larvae. [Deposited in USNM.]

1912. *Periclista quercus* Rohwer, Proc. U. S. N. M., XLIII (1930): 232–233. (♂, ♀.) [Type in USNM, Cat. No. 14554.] New synonymy.

The affinity of this species to *media* is close; the only noticeable difference lies in the slight variation of the clypeus. Dyar's report (1898) that the larvae of *albicollis* feed on the upper surfaces of the leaves, whereas *media* feeds on the lower surfaces, and that structurally the two larvae are different in the prepupal stage, further substantiates the separation of these two species.

With the exception of the following statements, this species is similar in color and structure in the adult form to *media*. The clypeus of *albicollis* is generally more emarginate, or depressed in the median portion, slightly more and deeper punctate, and almost always black or only the tips yellow. In size it is somewhat larger: females, average length, 6.2 mm., males, average length, 5.1 mm.

Hosts.—*Quercus alba* and *Quercus velutina* (*tinctoria*); Dyar, 1898.

Norton states in his description of *Selandria albicollis* that in the males "the outer under wing cells [are] all open." But if the specimens reared and identified by Dyar really are *albicollis*, then Norton must have overlooked the peripheral vein surrounding the outer cells of the hind wings. Until the type can be located, Dyar's conception of *albicollis* may be accepted.

Distribution Records.—Specimens examined 11; 2 ♂, 9 ♀.

ILLINOIS: 1♀; Algonquin; May 12, 1906; (W. A. Nason); [INHS]. MASSACHUSETTS: 1♂, 2♀; Boston, Forest Hills; June, 1910; (W. M. Wheeler); larvae on white oak; [types of *quercus*, USNM]. 1♀; Sharon; May 31, 1909; [MCZ]. NEW JERSEY: 1♀; Camden; May 8, 1912; (M. C. Van Duzee); [CAS]. NEW YORK: 1♂, 2♀; Bellport, Brookhaven, and Yaphank, Long Island; (H. G. Dyar); reared from oak; [USNM]. OKLAHOMA: 1♀; Riple; April 18; [INHS]. TEXAS: 1♂; "Texas (Belfrage)"; [type of *albicollis*, missing]. 1♀; "Tex"; (C. V. Riley); [INHS].

Periclista linea new species (Figs. 9, 19, 24, 31.)

Remarkably similar to its European ally, *lineolata*, this species is difficult to differentiate from the other species in the *Lineolata* complex. The male of *linea* can be recognized by the narrow malar space and by the simple but large valvispina which is positioned across the central portion of the penis valve. The narrow malar space of the female will serve to distinguish this species from the eastern North American species, *media* and *albicollis*.

FEMALE.—Average length, 6.6 mm. General color black but subject to considerable variation in extent; clypeus occasionally, labrum, posterior corners of collar, tegulae, frequently pleurae and posterior margin of dorsal segments of abdomen, yellowish-white; mesoepisternum and katepimeron often chestnut; legs except bases of coxae, yellow-orange.

Malar space narrow, hardly more than the width of the anterior tibial spur; clypeus weakly emarginate, not nearly so deeply as *lineolata;* anal cell of hind wing with petiolate vein; lance and lancet typical of this complex, figs. 8, 9, 10.

MALE.—Average length, 5.0 mm. Similar to female, usually darker except dorsum of abdomen often lighter in color; coxae, trochanters, and bases of femora occasionally black; hind wing with peripheral vein; genitalia with large valvispina occupying the mid portion of the penis valve, fig. 31. Base of harpes extended, truncately and broadly, although this character is not distinct if the base is weakly sclerotized, fig. 19.

Holotype. Female; Corvallis, Oregon; April 14, 1934; (H. A. Scullen); INHS.

Allotype.—Male; Corvallis, Oregon; March 24, 1926; INHS.

Paratypes.—CALIFORNIA: 1♀; Angora L., Tahoe; June 22, 1915; (E. C. Van Dyke). 35♂, 12♀; Berkeley; February 23–March 26, 1948; (W. Middlekauff, R. E. Beer); on *Quercus agrifolia.* 1♂, 4♀; Carmel, Monterey Co.; May 20, 1913, March 25, 1919, April 8, 1928; (E. P. Van Duzee, E. C. Van Dyke, L. S. Blevin). 2♀; Cazadero; April 12–14, 1918; (J. C. Bradley, E. P. Van Duzee).

1 ♀; Cypress Ridge; April 11, 1920; (E. C. Van Dyke). 2 ♀; Fairfax; April 11, 1923; (W. M. Giffard). 1 ♂, 1 ♀; Lagunitas, Marin Co.; April 26, 1924; April 23, 1927; (H. H. Keifer, E. P. Van Duzee). 16 ♂, 4 ♀; Mill Valley, Marin Co.; February 19–March 14, 1925; 1926; (M. C. Van Duzee, H. H. Keifer, E. P. Van Dyke). 1 ♀; Muir Woods, Marin Co.; April 23, 1911; (E. C. Van Dyke). 2 ♂, 3 ♀; Mt. St. Helena; May 7, 1930; (E. C. Van Dyke). 1 ♂; Oakland Hills, Alameda Co.; March 22, 1908; (Van Dyke). 1 ♀; Oreville; March 13, 1928; (H. H. Keifer); "on *Cean. cuneatus.*" 1 ♀; S. Anselmo; April 16, 1922; (E. P. Van Duzee). 5 ♀; Tilden Regional Park, Contra Costa, Co.; March 26, 1948; (R. E. Beer); "on *Quercus agrifolia.*" 1 ♀; Tuolumne; April 15, 1934; (E. P. Van Duzee). 2 ♂, 1 ♀; Yosemite Valley; May 17, 1921; (E. C. Van Dyke). OREGON: 1 ♂, 2 ♀; Corvallis; March 24, 1926, April 6, 1936, April 16, 1937.

Paratypes will be deposited in the collections of the Academy of Natural Sciences of Philadelphia, the California Academy of Sciences, Cornell University, Illinois Natural History Survey, the United States National Museum, and in the collection of W. Middlekauff, Berkeley, California.

Periclista naranga new species (Fig. 10.)

This species deviates from the usual darker color pattern of the *Lineolata* group to such an extent that, except for the head, it is almost completely orange-yellow to light chestnut. *Periclista media* shows tendencies in this direction, but in *media* the thorax is black, at least on the lobes of the notum and pectus. The narrow malar space and the smaller size of this species further distinguishes it from *media*.

FEMALE.—Length, 4.5–4.7 mm. Body color, orange-yellow to chestnut; head, except for the apices of the clypeus, labrum, and mandibles, edges of the cervical sclerites and basisternum, line along upper margin of the mesoepisternum, streaks on the lobes of the scutellum, dorsum of the thorax from the post-tergite to the abdomen, dorsum of first abdominal segment, submarginal veins of the wings, and tip of sheath, brown to black; labrum, posterior margins of collar, tegulae and legs occasionally (except tarsi), yellow to white; tarsi often darker chestnut to light brown.

Malar space narrow, hardly wider than width of anterior tibial spur; anal cell of hind wing with a petiolate vein; genitalia typical of the *Lineolata* complex, figs. 8, 9, 10.

Holotype.—Female; Alpine, California; April 10, 1915; (M. C. Van Duzee); [CAS].

Paratypes.—1 ♀; same data as holotype. 1 ♀; S. Arista Canyon, California; April 11, 1916; (J. O. Martin).

Paratypes will be deposited in the collections of the Academy of Natural Sciences of Philadelphia and the Illinois Natural History Survey.

Periclista spicula new species (Fig. 30.)

The smallest of the Nearctic *Periclista,* this species is known from a single male specimen captured in California. Its diminutive size may not be typical of the species since dwarf forms are common in the Hymenoptera. Its distinguishing character is found primarily in the genitalia. The spine on the abossicular margin of the penis valve formed by an extension of the valvispina affords a means of differentiating this species from the rest of the *Lineolata* complex.

MALE.—Length, 4.0 mm. Generally shiny black in color; apical margin of clypeus, labrum, posterior corners of collar, tegulae, and posterior margins of the abdominal sternites, yellow-white; abdomen in the dried specimen chocolate-brown to black; apices of coxae, trochanters, and femora, and all of the tibiae and tarsi yellowish-brown.

Malar space narrow, less than the width of the anterior tibial spur; antennal segments slightly thickened; hind wings with a peripheral vein; genitalia typical of the *Lineolata* complex except for spine on penis valve, fig. 30.

Holotype.—Male; Claremont, California; (Baker); [CAS].

Melanocephala Complex

Named after the oldest known species in the genus, this complex contains most of the species formerly grouped under the genus *Isodyctium* Ashmead. The non-petiolate or subpetiolate anal cell of the hind wing, the character used by Ashmead (1898) to distinguish the genus *Isodyctium,* is dropped to a secondary position with qualifications in the definition of the *Melanocephala* complex.

Included here are those members of the subgenus *Periclista* that possess a weakly sclerotized saw of about 24 serrulae, armed with an average of four to five fine ventral teeth between the sutures of the saw. The dorsal membrane occupies only the apical third of the length of the lancet, and the pores appear in the middle of the saw, fig. 2. The penis valve, figs. 27, 28, 29, is similar in outline to the species in the *Lineolata* complex but here the large valvispina is lacking, and the apical lip formed by the scales is absent. Equally marked characters in the males can be noted in the reduction of the parapenis, and in the expansion of the base of the harpes into an oblique flange.

These species are generally robust, more so than in any of the other groups. In color they vary from black to orange-yellow; frequently the mesoepisternum is chestnut, and in every case the white upper margin of the mesoepisternum is conspicuous. The anal cell of the hind wing is often without a petiolate vein, which, if present, is very short, never longer than one-half the width of the anal cell. In many specimens vein 3m-cu does not appear in the hind wing.

An unusual parallel of structural development is found in *Periclista* (*Neocharactus*) *inaequidens*. In color, in the robust appearance, and in the reduction of the petiolate vein of the anal cell, *inaequidens* is superficially similar to the *Melanocephala* complex species. But in *inaequidens*, the reduced saw is heavily sclerotized and the ninth abdominal segment is enlarged, indicating its position in the subgenus *Neocharactus*.

Within this complex, there are two well-marked groups based on morphological characters; within one of these groups are two other groups based on biological behavior. The primary structural groups are divided on the form of the clypeus, on the presence or absence of sub-basal teeth in the saws and on the shape of the harpes. The species *sulfurana* and *bipartita* are allied by the slightly depressed median margin of the clypeus, by the existence of sub-basal teeth on the lancet, and by the shorter, broad harpes. On the other hand, the species *caryicola, entella, rileyi,* and *diluta* show their inter-relationship by the depression of the clypeus along its entire apical margin, by the absence of sub-basal teeth in the saw, and by the elongate harpes. From among the latter four species, *caryicola* may be separately categorized by its preference for hickories whereas the others, as far as is known, feed on oaks.

Periclista bipartita (Cresson) (Figs. 17, 27.)

1880. *Selandria* (*Blennocampa*) *bipartita* Cresson, Trans. Am. Ent. Soc., VIII: 12. (♂.) [Type No. 186, ANSP.]

1894. *Blennocampa bipartita* (Cresson); Dalla Torre, Cat. Hymen., I: 170.

1894. *Blennocampa bipartita* (Cresson); Dyar, Can. Ent., XXVI: 185. Description of larva.

1895. *Mogerus emarginatus* MacGillivray, Can. Ent., XXV: 281. (♂.) [Type in MCUI.] New synonymy.

1898. *Periclista emarginata* (MacGillivray); Dyar, Journ. N. Y. Ent. Soc., VI: 131. Description of ♀ and larvae. [Deposited in the USNM.]

1898. *Isodyctium murtfeldtiae* Dyar, Journ. N. Y. Ent. Soc., VI: 135. (♀.) [Type in USNM.] New synonymy.

On the basis of the female ovipositor and the broad harpes of the male, this species and *sulfurana,* are distinct from the rest of the genus. From *sulfurana, bipartita* can be separated by its darker color.

FEMALE.—Length, 5.3 mm. Head, thorax, and dorsum of abdomen mostly black; tips of clypeus and labrum, orange-yellow; apices of mandibles, red; posterior corners of collar, tegulae and a line on the uppermost margin of the mesoepisternum, orange to white; thorax varied, either entirely black, or brown with black spots on the lobes of the scutum; venter and pleurae of abdomen mostly orange-yellow to white; sheath darker; legs, orange-brown, except for bases of coxae and trochanters which are black.

Clypeus, moderately emarginate, depressed slightly at the median point of its margin; malar space broad, 3 times the width of the anterior tibial spur; anal cell of hind wing with very short petiole vein; sheath pointed at tip; saw similar in appearance to fig. 4 which illustrates the concentration of numerous fine teeth at the base of each serrula.

MALE.—Length, 6.3 mm. Generally the same as the female in color and structure. Peripheral vein present in hind wing; harpes broad, basal margin straight, fig. 17; penis valve without valvispina, fig. 27; parapenis similar to fig. 16.

Host.—Black oak, *Quercus coccinea* (Dyar, 1898).

From among the Texas material presented by Belfrage, E. T. Cresson described *Selandria bipartita.* At least three males were available to him but only one of these specimens corresponds exactly to his description and that one was later designated as the holotype, Cresson (1916). One of the other two paratype males compares favorably with the type, but the third specimen is not conspecific; instead it is a representative of *Periclista caryicola.* It is unfortunate that the misidentified specimen was used by

MacGillivray to formulate his concepts of *bipartita,* for upon this basis, MacGillivray described *emarginata* as different from *bipartita.* Actually the *bipartita* cotype in his possession was a new species subsequently described by Dyar as *caryicola.*

Dyar (1894) reared and described the larva under the correct impression that the resultant imago was *P. bipartita.* The reared specimen was then submitted to MacGillivray for examination and was described as the new species *emarginata* MacGillivray (1895); Dyar (1895) also made a note of this change in identity in his key to the larvae of North American sawflies. These decisions essentially placed *bipartita* Cresson with the unknown species and rarely was it mentioned again. The female and other larval stages were described as *emarginata* in 1898 by Dyar who listed as the host plant, black oak. In the same paper, Dyar further described what I believe is the lighter phase under the name *murtfeldtiae* from a specimen from black oak sent to him by Miss Murtfeldt of Missouri. Dyar in his descriptions of the *murtfeldtiae* larvae presumed that there were "3 spines on both the 2nd and 4th annulets" but he remarked that actually the arrangement was not discernible in the specimens on hand, and, therefore, these supposed differentiating larval characteristics of *murtfeldtiae* cannot be upheld until more material can be collected and studied.

Distribution Records.—Specimens examined 7; 3♂, 4♀.

FLORIDA: 1♀; Jacksonville; April 7, 1914; (L. H. Well); [INHS]. MASSACHUSETTS: 1♂; Boston; reared from oak; (H. G. Dyar); [type of *emarginata,* MCUI]. MISSOURI (?): 1♀; "Miss Murtfeldt, No. 207 M"; type of *murtfeldtiae,* [USNM]. NEW YORK: 2♀; Pelham Manor and Van Cortlandt Park; reared from *Q. coccinea;* May; (H. G. Dyar); [USNM]. TEXAS: 2♂; "Tex[as]"; (Belfrage); [types of *bipartita,* ANSP].

Periclista caryicola (Dyar) (Figs. 1, 3, 18, 28, 37, 39.)

1895. *Mogerus bipartita* (Cresson); MacGillivray, Can. Ent., xxv: 281. Misidentification.

1897. *Mogerus caryicolus* Dyar, Journ. N. Y. Ent. Soc., v: 193. ♂, ♀, & larvae.) [Types in USNM.]

1898. *Isodyctium calricolum* (Dyar); Dyar, Journ. N. Y. Ent. Soc., VI: 135–136.

1908. *Isiodyctium atratum* MacGillivray, Can. Ent., XL: 290. (♀.) [Type in MCUI.] New synonymy.

1917. *Periclista hicoriae* Rohwer, Proc. U. S. Nat. Mus., LIII: 154–155. (♀.) [Type in USNM, cat. no. 19041.] New synonymy.

1920. *Periclista plesia* Rohwer, Proc. U. S. Nat. Mus., LVII: 211. (♀.) [Type in USNM, cat. no. 21697.] New synonymy.

1920. *Periclista pecanivora* Rohwer, Proc. U. S. Nat. Mus., LVII: 212. (♀.) [Type in USNM, cat. no. 22203.] New synonymy.

1922. *Periclista hicoriae* Rohwer; Middleton, Proc. U. S. Nat. Mus., LXI (2442): 2–4. Description of larvae. [Deposited in USNM, Hopk. U. S. no. 11364.]

This robust species of *Periclista* is generally orange-brown and black in color, and the white clypeus is closely appressed to the head. It is the only species known in this genus that departs from the oak habitat to feed instead on hickories.

Periclista caryicola is most closely related to *diluta* and *entella* but it can be distinguished from *diluta* by color and by the shape of the sheath, and from *entella* it can be separated by the form of the clypeus.

FEMALE.—Average length, 5.7 mm. Head and thorax predominately black; most of clypeus, labrum, bases of mandibles, posterior margins of collar, tegulae, bases of wings, the uppermost edge of the mesoepisternum and katepimeron, white; occasionally tendency for area between antennae, upper inside portions around the eyes, ventral surfaces of the apical segments of the antennae, often most of the mesoepisternum, parts of the praescutum, scutum, scutellum and post-tergite, orange-brown; dorsum of abdomen, olive-yellow to orange-brown, or with black on the median portion; venter and pleurae of abdomen, especially the ninth sternite, pale yellow to white; commonly with brown speckles or spots along pleurae of abdomen; legs, yellow-orange, except coxae which are black at the base and white on lateral and apical aspects.

Robust; clypeus weakly emarginate, broadly flat, closely appressed to the head; malar space broad; anal cell of hind wing without petiole or with subpetiole vein; frequently 3m-cu missing in the hind wing; sheath tip sharply pointed, fig. 39; saw weakly sclerotized having about 24 serrulae, with four or five fine ventral teeth per serrula; dorsum of lance flat, figs. 1–3.

MALE.—Average length, 5 mm. Similar to female, except antennae stouter; hind wings with a peripheral vein; thorax and head usually darker in color; harpes narrow, fig. 18; penis valve without valvispina, fig. 28; parapenis as in fig. 25, slightly larger in size than that of *sulfurana*, fig. 16.

Hosts.—The genus *Carya*: *Carya ovata, Carya glabra,* "pecan" (various authors).

It would seem by Rohwer's additional note (1920, p. 212) that the blunt mandibles of his type, *hicoriae*, are good characters to set it apart as a distinct species. Yet other specimens from the same rearings, not mentioned in his descriptions, possess normal pointed mandibles. This leads me to believe that the types of *hicoriae* are merely malformed specimens and as such are variants of the typical form. Middleton (1922), after a consideration of the larvae, felt that *hicoriae* "agrees very well" with *caryicola* in the immature stages.

The adults appear in spring just as the hickory buds have started to swell. Characteristically, they are weak fliers, often traveling only from bud to bud or crawling along the stems toward the buds. When caught in a net they remain for some time attached to the sides rather than drop to the bottom with their legs drawn in as is typical of many of the blennocampines.

Distribution Records.—Specimens examined 61; 23 ♂, 38 ♀.

CONNECTICUT: 1 ♀; Portland; May 15, 1914; (B. H. Walden); "on pine"; [type of *plesia,* USNM]. ILLINOIS: 1 ♂; Algonquin; (Nason); "5815"; [INHS]. 1 ♀; Alto Pass; April 18, 1927; (R. D. Bird); [INHS]. 1 ♀; Carlinville; April 29, 1895; (Charles Robertson); [INHS]. 1 ♀; Dixon Springs; April 12, 1924; [INHS]. 1 ♀; Dubois; April 24, 1914; [INHS]. 12 ♂, 7 ♀; Kickapoo State Park; May 1, 1947; (Ross and Stannard); on *Carya* sp.; [INHS]. 1 ♀; New Columbia; April 22, 1932; (Ross and Mohr); [INHS]. 1 ♀; St. Joseph; May 7, 1905; (C. A. Hart); "36179"; [INHS]. 1 ♀; Urbana (Cott.); April 30, 1914; (T. H. Frison); [INHS]. 2 ♀; White Heath; April 25, May 8, 1915; [INHS]. IOWA: 1 ♂; Mt. Pleasant; April 28, 1934; (Knutson); [HEJ]. 1 ♀; Ames, May 10, 1897; [type of *atratum,* MCUI]. MASSACHUSETTS: 1 ♀; Wellesley; May 7, 1902; [INHS]. MISSISSIPPI: 5 ♂, 4 ♀; "Agr. Coll. Miss."; April 10, 18, 19, 1915; (C. C. Greer); pecan; [MAC, INHS]. 1 ♂; "Agr. Coll. Miss."; March 25, 1916; (J. L. E. Lauderdale); [MAC]. 1 ♀; "A. & MC."; April 27, 1914; (K. U. Jones); [MAC]. 1 ♀; "Agr. Coll. Miss."; March 25, 1916; (G. T. Neill); [MAC]. NEW JERSEY: 1 ♂, 1 ♀; Fort Lee; last of May; (Dyar Collection); hickory; [type of *caryicola,* USNM]. NEW YORK: 2 ♀; Bronx Park and Bedford Park; May; (Dyar Collection); hickory; [USNM]. PENNSYLVANIA: 1 ♂, 4 ♀; Charter Oak; reared May 7, 1914; (T. E. Snyder); *Hickoria;* [types of *hicoriae,* USNM]. 1 ♀; Huntingdon; May 28, 1934; [MIDD]. TEXAS: 1 ♂; "Tex(as)"; (Belfrage); [misidentified cotype of *bipartita,* MCUI]. 1 ♀; Calvert; April 2, 1907; (C. R. Jones); [INHS]. 1 ♀; Paris; March 31, 1908; (E. S. Tucker); on *Crataegus;* [INHS]. 2 ♀; San Saba; April 20, 1918; (A. I. Fabis); "pecan"; [type of *pecanivora,* USNM]. VERMONT: 1 ♀; Hydeville; May 17, 1927; (Gip. Moth Lab.); on *Ulmus americana;* [USNM].

Periclista entella MacGillivray (Fig. 25.)

1923. *Periclista entella* MacGillivray, U. of I. Bull., XXI (50): 29. (♂.) [Type in MCUI.]

With the exception of the deeply emarginate clypeus, this species is very close in color and structure to *caryicola*. Since it is known only from the type male, no attempt is made here to enumerate any other diagnostic characters because the slight differences noted may be subject to individual variation. In spite of the marked relationship to *caryicola,* it is my belief that this species is quite distinct. Certainly it must feed on another host plant since hickories are not found on the West Coast.

Distribution Record.—1 ♂; Corvallis, Oregon; "4/18"; (Peterson); campus; [type of *entella,* MCUI].

Periclista diluta (Cresson) (Figs. 2, 40.)

1880. *Selandria* (*Monophadnus*) *diluta* Cresson, Trans. Am. Ent. Soc., VIII: 12. (♀.) [Type No. 190, ANSP.]

1894. *Monophadnus dilutus* (Cresson); Dalla Torre, Cat. Hymen., I: 162.

1898. *Isodyctium subgregarium* Dyar, Journ. N. Y. Ent. Soc., VI: 134. (♂, ♀.) [Types in USNM.] Synonymized by Rohwer (1917).

In coloration and appearance this species is remarkably similar to *P. sulfurana* but is easily separated by the arrangement of the teeth in the saw. It is more closely related to *rileyi,* differing mostly by the head color. The head of *diluta* is uniformly orange-yellow, whereas the head of *rileyi* is predominately black except for the yellow marginal streak around the inner orbits. Should any teneral specimens of *caryicola* be found, the pointed sheath tip will differentiate it from *diluta* which possesses a broadly truncated tip, figs. 39, 40.

FEMALE.—Average length, 6.5 mm. Almost entirely orange-yellow; tips of clypeus, labrum, collar, tegulae, uppermost margin of the mesoepisternum, white; abdomen yellowish-orange to cream; antennal segments 2 to 9, sutures behind the ocelli, spots on the lateral areas of the metathorax, black.

Body robust; clypeus weakly emarginate, flat, and tip somewhat evenly appressed to head; malar space broad; anal cell of hind wing with very short petiole vein; sheath broadly truncate at tip, fig. 40, saw as in figs. 1–3, with only 4 or 5 teeth per serrula; dorsum of lancet flat.

Hosts.—White oaks, *Quercus alba, Q. prinus* (Dyar, 1898).

According to Dyar's description of the male, most of the orange-yellow of the head and thorax is replaced with black as is typical of this complex.

Distribution Records.—Specimens examined 23; 23 ♀.

CANADA: 1 ♀; "Canada"; (Saunders); [Holotype of *diluta*, ANSP]. ILLINOIS: 1 ♀; Muncie; May 4, 1936; (Ross & Burks); [INHS]. 2 ♀; White Heath; May 1, 1915; [INHS]. KANSAS: 1 ♀; Onarga; May 16, 1923; (Crevecoeur); [KSC]. 1 ♀; Riley County; April 27; (G. A. Dean); [KSC]. MASSACHUSETTS: 1 ♀; Wellesley; May 1, 1903; [INHS]. MICHIGAN: 1 ♀; Lake County; May 30, 1939; (Dreisbach); [INHS]. MISSOURI: 1 ♀; "Mo."; (Riley); [Paratype of *diluta*, MCUI]. NEW YORK: 1 ♀; Bronx Park, Long Island, Pelham Manor; May; (Dyar); "white oaks"; [Type of *subgregarium*, USNM]. 7 ♀; Ithaca; May 22–23, 1900; (C. O. Houghton); [INHS, MCUI]. 1 ♀; Ithaca; May 12, 1899; [INHS]. 1 ♀; Nassau; May 6, 1902; [INHS]. 1 ♀; W. Danby; May 30, 1915; [CU]. PENNSYLVANIA: 2 ♀; Huntingdon: May 3–17, 1934; [INHS, MIDD]. 1 ♀; Philadelphia; May 25, 1898; [ANSP].

Periclista rileyi (Cresson)

1880. *Selandria* (*Monophadnus*) *Rileyi* Cresson, Trans. Am. Ent. Soc., VIII: 13. (♀.) [Type No. 359, ANSP.]

1894. *Monophadnus rileyi* (Cresson); Dalla Torre, Cat. Hymen., I: 164.

1898. *Isodyctium floridense* Dyar, Journ. N. Y. Ent. Soc., VI: 134. (♀.) [Type in USNM.] New synonymy.

Insufficient numbers of collected specimens of this species limit an evaluation of its status. Its relationship to *diluta* is marked by its similarity in color and structure, differing only by the darker head with yellow oribital lines. Whether or not it represents but a color deviation from the *diluta* form cannot at present be determined. Dyar's species, *floridense*, seems to be a slightly lighter color variant from *rileyi*. Only three female specimens are known; the male, larvae, and host plant have never been reported.

Distribution Records.—Specimens examined 3; 3 ♀.

FLORIDA: 1 ♀; Florida; (Dyar); [Type of *floridense*, USNM]. ILLINOIS: 1 ♀; "Ill."; May 14; [INHS]. MISSOURI: 1 ♀; Missouri; (C. V. Riley); [Type of *rileyi*, ANSP].

Periclista sulfurana new species (Figs. 4, 16, 29.)

The orange-yellow color of this species is identical to the coloration found in *diluta*. However, the basal margin of each serrula contains 3 or 4 fine sub-basal teeth which places *sulfurana* nearer *bipartita*. As shown in the following description, this species can be separated from *bipartita* by the orange, instead of black head in the female and by the shape of the harpes in the male.

FEMALE.—Length, 6 mm. General color, orange-yellow; tips of clypeus, labrum, appendages of the mouth parts, posterior angles of collar, tegulae and marginal line of mesoepisternum light yellow to white; venter and pleurae of abdomen somewhat lighter orange to white; sutures above ocelli, streaks on postocular area, spot above antennae, antennal segments 2 to 9, sutures of scutum, sometimes basisternum, and sheath brown to black; apices of mandibles, red.

Body robust; malar space broad, at least 3 times the width of the anterior tibial spur; clypeus moderately emarginate, depressed at the median point of its margin; sheath tip blunt but not distinctly truncate; anal cell of hind wing without petiole vein or with subpetiole vein; saw weakly sclerotized with about 24 serrulae, figs. 1, 2, and with 3 or 4 fine sub-basal teeth per serrula as in fig. 4.

MALE.—Length, 5.5 mm. Much darker in color than female, black replacing orange of the female on head and thorax; antennae thicker than in female; hind wing with a peripheral vein; harpes, fig. 16, with a bulge on its basal margin, penis valve without valvispina, fig. 29; parapenis relatively reduced, fig. 16.

Holotype.—Female; Effingham, Illinois; May 1, 1936; (Ross and Mohr); on *Quercus* sp.; [INHS].

Allotype.—Male, same data as above.

Paratypes.—11 ♀ and 1 ♂, same data as above; 1 ♀; Mt. Pleasant, Iowa. 1 ♀; Gr. Pl. Mead., N. J. 1 ♀; Stephentown, N. Y. 1 ♀; Milford, Oakland Co., Mich. 1 ♀; Urbana, Ill.; April 26, 1890; (15652); (Hart).

Paratypes will be deposited in the collections of the Academy of Natural Sciences of Philadelphia, the Illinois Natural History Survey, and the United States National Museum.

Californica Complex

In North America this complex is represented by three species. They are more slender in appearance than their congeners; the area immediately below the ocelli is slightly convex, especially noticeable when compared with species of other complexes; the head is minutely but evenly punctate which by contrast makes the thorax seem polished; and the petiole vein of the anal cell of the hind wing is long, at least longer than the width of the anal cell.

In many ways this complex has points that might be considered as intermediates between the other groups. The delicate saw is more nearly like that found in the *Melanocephala* complex except for the greater number of fine teeth to each serrula. Spines on the apical portion of the lance are more numerous than in the *Melanocephala* group but they are not quite as extensive as on the lance of the *Lineolata* complex species. Not only do the females show this intermediate position, but also this tendency can be seen in the males. The penis valve bears a small valvispina, extended to a point less than half the distance across the widest portion of the aedeagus. In the *Melanocephala* complex the valvispina has entirely disappeared, but this structure is highly developed in the *Lineolata* group. The shape of the harpes is more similar to the *Lineolata* complex species, fig. 20.

Present distribution records limit these three species to the West Coast—California to Oregon. Some adult specimens have been collected from oaks but the larvae still remain unknown.

Periclista californica Rohwer (Figs. 20, 26, 32.)

1917. *Periclista californica* Rohwer, Proc. U. S. N. M., LIII (2195) : 154. (♀.) [Type in USNM, Cat. No. 19040.]

One of the most distinctive of the periclists, this species can be recognized by the yellow inner orbital lines against the black background of the head. The female genitalia are scarcely distinguishable from *electa* and *vergorba,* but the penis valves of the males of *californica* possess a shorter valvispina than that found in *electa.*

FEMALE.—Average length, 6 mm. Body, especially head and thorax considerably black; inner orbital line extending to the post-ocellar furrows, spot above and between the antennae, line on cheeks extending around behind the eyes, lateral margins of the praescutum, most of collar, mesoepisternum, katepimeron, coxae and apical two-thirds of trochanters, abdomen excluding a broad median band on the dorsum, and sheath, yellow; clypeus, labrum, bases of mandibles, and tegulae, white; legs and marginal veins of wings, tan.

Body slender; head round when mandibles closely retracted; malar space broad, two times the width of anterior tibial spur; clypeus moderately emarginate, flat; anal cell of hind wing with petiole vein; sheath pointed but not drawn out into a tip; saw similar to figs. 5, 6, 7, with 8 to 12 fine teeth per serrula.

MALE.—Length, 5.5 mm. Similar in color to female, although black areas slightly more extended. Mesoepisternum darker but retaining, at least, the yellow-white upper marginal line. Hind wing with a peripheral vein. Penis valve as in fig. 32, valvispina shorter than the corresponding structure in *electa.*

Rohwer in his original description of *californica* prefaced his remarks by the statement, "*Periclista mutabilis* Rohwer, Can. Ent., Vol. 41, 1909, p. 398. (Not Konow.)" This reference points out his previous supposition that *californica* was presumably Konow's species and as such was keyed out as *mutabilis* in Rohwer's *Notes on Tenthredinoidea,* 1909, page 399 (not 398).

Distribution Records.—Specimens examined 19; 2♂, 17♀.

CALIFORNIA: 3♀; Alameda Co.; March 10, 1928; (R. L. Usinger); [INHS]. 1♀; Berkeley; April 23, 1935; [INHS]. 1♂; Berkeley; February 23, 1948; (R. E. Beer); [MIDD]. 4♀; Carmel, Monterey Co.; March 25, 1919; (E. P. Van Duzee); [CAS, INHS]. 1♀; Claremont; (C. F. Baker); [Type of *californica,* USNM]. 1♀; Fairfax, Marin Co.; March 20, 1927; (C. L. Fox); [ANSP]. 1♀; Golden Gate Park, San Francisco Co.; April 21, 1912; (J. C. Thompson); [CAS]. 1♀; Hastings Natural History Reservation, Monterey; April 27, 1939; (J. M. Linsdale); [HNHR]. 4♀; Mill Valley, Marin Co.; March 11–17, 1925–1928; (H. H. Keifer, M. C. Van Duzee, R. L. Usinger): [ANSP, CAS, INHS]. 1♀; Morago Valley, Contra Costa Co.; April 4, 1920; (E. P. Van Duzee); [CAS]. 1♂; Oakland, Alameda Co.; March 22, 1908; (Van Dyke); [INHS].

Periclista electa MacGillivray (Figs. 21, 33, 38.)

1923. *Periclista electa* MacGillivray, Psyche, xxx (2): 80. (♂.) [Type in MCUI.]

This species is allied to *californica* from which it may be separated by the color of the head. It is very closely related to *vergorba* differing only in the color of the abdomen and slightly in the wing venation.

FEMALE.—Average length, 5 mm. Body black; labrum, the outer margin of the tegulae, and a fine line on the posterior margins of the segments of the abdomen, white or yellowish-white; legs beyond the bases of the femora, yellow to tan.

Body slender, eyes inclined towards the mandibles, fig. 38, not as in fig. 37; malar space broad, at least twice as wide as the width of the anterior tibial spur; clypeus narrow, circularly emarginate; 2R of the forewing joined to Rs basad to junction of 3r-m; sheath pointed but not formed into a tip; saw weakly sclerotized, with 8 to 12 fine teeth per serrula, serrulae 24 in number as in fig. 6.

MALE.—Length, 4.7 mm. Identical in color and in general structure to the female. Genitalia with a small valvispina, fig. 33, larger than that found in *californica.* Harpes as in fig. 20.

Host.—Adults found on oaks.

Distribution Records.—Specimens examined 12; 2♂, 10♀.

CALIFORNIA: 1♀; Alpine; April 10, 1915; (M. C. Van Duzee); [INHS]. 1♂, 4♀; Carmel, Monterey Co.; March 25, 1919; (E. P. Van Duzee); [ANSP, CAS, INHS]. 2♀; Mill Valley, Marin Co.; February 28 & March 6, 1926; (E. P. Van Duzee); [CAS, INHS]. 1♀; Palm Springs, Riverside Co.; April 3, 1925; (E. C. Van Dyke); [CAS]. 1 ♀; Sequoia National Park; May 21, 1929; (E. C. Van Dyke); [INHS]. 1 ♀, Yosemite Valley; May 29, 1921; (E. C. Van Dyke); [CAS]. OREGON: 1 ♂; Corvallis; April 13, 1908; on oak twig; [type of *electa*, MCUI].

Periclista vergorba new species (Figs. 5, 6, 7.)

Although this species can be readily distinguished from its allied species *electa*, the structural relationship of the two is extremely close. Known only from the type, *vergorba* may be separated from others of its group by the color of the abdomen and by the placement of 2R in the forewing.

FEMALE.—Length, 7 mm. Head, thorax, and sheath, black; labrum and tegulae, white; tips of mandibles red; abdomen, legs beyond the bases of the femora and marginal veins of the wings, red-orange.

Relatively slender; eyes with a slight tendency to converge toward the bases of the mandibles; malar space broad; clypeus narrow, moderately circularly emarginate; head, except clypeus, finely and evenly pitted; thorax more polished; anal cell of hind wing with petiole vein, at least as long as the width of the anal cell; 2R of forewing joined to Rs distad to junction of 3r-m; sheath pointed but not elongated into a tip; saw weak, with 8 to 12 fine teeth per serrula, figs. 6, 7, distal portion of lance slightly toothed, fig. 5.

Holotype.—Female; Giant Forest, Tulare Co., California; July 18, 1928; (C. I. Fox); [INHS].

Subgenus **Neocharactus** MacGillivray

1908. *Neocharactus* MacGillivray, Can. Ent., XL: 293. Monobasic, genotype—*Neocharactus bakeri* MacGillivray.

1908. *Aphanisus* MacGillivray, Can. Ent., XL: 295. Genotype by original designation—*Aphanisus lobatus* MacGillivray. Synonymized under *Periclista* by Ross (1937).

For the present, the species in this group, as indicated in the key, are placed here under the heading of a subgenus. The characters that set these species apart from *Periclista* s. str. are of sufficient distinction to probably warrant the elevation of *Neocharactus* to full generic rank. However, it may be more feasible to retain *Neocharactus* as a subgenus until the Blennocampinae are better understood and more completely subdivided into tribes. Benson (1938) has separated six tribes from the Blennocampini, but Blennocampini, itself, still has various elements within it. In order to represent the relationship of *Periclista* to its closest ally, *Neocharactus*, it is more comprehensible to include them as subgenera and thus differentiate these two from other near relatives such as the genus *Ardis* and perhaps the genus *Pareophora.*

Aphanisus MacGillivray (1908) contained species of a number of genera, namely: *Blennocampa, Ardis,* and *Neocharactus.* Since the designated genotype, *lobata,* proved to belong to the *Neocharactus* group, *Aphanisus* is a name synonymous with *Neocharactus* now that it is removed as a subgenus from *Periclista* s. str.

As shown in the accompanying key, the female sex can be recognized by (1) an enlargement of the ninth abdominal sternite tc accommodate the larger muscles that operate, (2) the more heavily sclerotized saw, (3) the reduction of the saw from the usual *Periclista* number of about 25 segments to about 10, (4) the numerous stout spines or ctenidia along the margins of the sutures of the lancet, and (5) the bulged clypeus that may slightly protrude from the head. Although the bulged clypeus is a minor detail, this condition, most easily seen in *subtruncata,* is suggestive of the more aggravated protrusion found in the genus *Blennocampa* and, therefore, may be another point to add to the list of similarities between these two genera. The lack of the peripheral vein in the hind wings of the males further separates these species from the main group of *Periclista.*

Eastern species of this subgenus are rare in collections. A male is known to me for only one of the eastern forms, *subtruncata,* and that by but one specimen. The two California species, *occidentalis* and *bakeri,* have been collected more frequently including the males of both these species. It is unlikely that this group is rare in nature, rather their habits are either secretive or else collectors have made little effort to seek them out.

Little is known of the larvae except for the brief report on *subtruncata* and *inaequidens* made by Dyar (1898). All of the larval host plants so far discovered belong to the genus *Quercus,* and oviposition probably occurs just as the oak buds are beginning to swell.

Periclista inaequidens (Norton) (Fig. 14.)

1872. *Selandria inaequidens* Norton, Trans. Am. Ent. Soc., IV: 84. (♀.) [Type in ANSP, No. 10343.]

1882. *Monophadnus inaequidens* (Norton); Kirby, List Hymen. Brit. Mus., I: 177.

1898. *Isodyctium infrequens* Dyar, Journ. N. Y. Ent. Soc., VI: 134–135. (♀ & larvae.) [Type in USNM.] New synonymy.
1917. *Periclista xanthognatha* Rohwer, Proc. U. S. Nat. Mus., LIII (2195): 156–157. (♀.) [Type in USNM, cat. no. 19045.] New synonymy.

Superficially *inaequidens* resembles members of the *Melanocephala* complex by its robust appearance and general coloration. That it is a member of the subgenus *Neocharactus* is indicated by the characteristics of the saw, heavily sclerotized and reduced, and by the larger apical abdominal segments. Actually it stands alone in the subgenus, distinct and well defined.

FEMALE.—Average length, 6 mm. Color black; lobes of clypeus, labrum, collar broadly, tegulae, a fine line on the uppermost margin of the mesoepisternum, tips of the trochanters, parts of the meson of the venter of the abdomen, white; occasionally between the antennae and spots on the postocular area, the praescutum, parts of the scutum and scutellum, the mesoepisternum usually, abdomen and legs except the coxae and trochanters, orange-tan to orange-yellow.

Body robust; clypeus emarginate, flat, but not appressed tightly to head; anal cell of hind wing without a petiole vein or subpetiolate; saw heavily sclerotized, fig. 14, with only 12 serrulae and one sub-basal tooth per serrula; sheath thick when viewed from above.

MALE.—Unknown.

Host.—White oak, *Quercus alba;* (Dyar, 1898).

Giantism occurs in this infrequently encountered species; one specimen from Essex Co., New York was 2 mm. larger than the average-sized individual. Dyar's *infrequens* represents the darker color phase.

Distribution Records.—Specimens examined 7; 7 ♀.

ILLINOIS: 1 ♀; Norris City; March 28, 1935; (Ross & Mohr); [INHS]. NEW YORK: 1 ♀; Brookhaven and Bellport, Long Island; early in June; on white oak (*Q. alba*); (Dyar collection); [type of *infrequens,* USNM]. 1 ♀; Ithaca; "from the Chittenden collection"; [type of *xanthognatha,* USNM]. 1 ♀; Essex Co.; lot 143; May 5; [INHS]. TEXAS: 2 ♀; "Texas"; (Belfrage); [holotype of *inaequidens,* ANSP—paratype, USNM]. WISCONSIN: 1 ♀; Madison; May (?) 7, 1912; "Student collection"; [INHS].

Periclista subtruncata Dyar (Figs. 11, 12, 35.)

1898. *Periclista subtruncata* Dyar, Journ. N. Y. Ent. Soc., VI: 131–132. (♀ & larvae.) [Type in USNM.]
1908. *Aphanisus lobatus* MacGillivray, Can. Ent., XL: 295–296. (♀.) [Type in MCUI.] New synonymy.

1908. *Aphanisus muricatus* MacGillivray, Can. Ent., XL: 296. (♀.) [Type in MCUI.] New synonymy.

Considerable variation is exhibited by this species throughout its range; the southern populations are more apt to be lighter in color, smaller, and possess a slightly more reduced malar space than the northern specimens. A critical evaluation of the regional variations should be planned when additional specimens can be obtained.

FEMALE.—Average length, 6.5 mm. Color dark, purple-black to mahogany-brown; often with tip of clypeus, labrum, posterior margin of collar, tegulae, yellow or white; legs, except bases of coxae, occasionally a broad band on the mesoepisternum, and occasionally spots on the 9th abdominal sternite, orange-tan. Frequently in southern forms the entire abdomen is lighter brown.

Malar space variable from 1.5 to over 2 times as wide as the width of the anterior tibial spur; clypeus somewhat bulged, slightly to moderately emarginate; anal cell of hind wing with petiole vein; sheath, with a small pointed tip; saw with 3 to 5 sub-basal teeth extending upward on the saw, fig. 12.

MALE.—Length, 5.7 mm. General color similar to female; hind wing without a peripheral vein; penis valve as in fig. 35.

Host.—*Quercus coccinea* (Dyar, 1898).

Distribution Records.—Specimens examined 8; 7 ♀, 1 ♂.

FLORIDA: 1 ♀; Jacksonville; March 20; [INHS]. 1 ♀; Ormond; [type of *Aphanisus lobatus*, MCUI]. ILLINOIS: 1 ♀; Monticello; May 4, 1934; A. R. Park, Jr.; [INHS]. MARYLAND: 1 ♀; Great Falls; [INHS]. MISSISSIPPI: 1 ♂; George Co.; March 4, 1932; H. Dietrich; [INHS]. NEW YORK: 1 ♀; Ithaca; May 3, 1895; [type of *Aphanisus muricatus*, MCUI]. 1 ♀; Van Cortlandt Park; May; (Dyar collection); [type of *subtruncata*, USNM]. TEXAS: 1 ♀; College Station; April 2, 1939; H. J. Reinhard; [INHS].

Periclista bakeri (MacGillivray) (Figs. 15, 34.)

1908. *Neocharactus bakeri* MacGillivray, Can. Ent., XL: 293. (♂.) [Type in MCUI.]

1909. *Periclista leucostoma* Rohwer, Can. Ent., XLI, 397–398. (2 ♀, 5 ♂.) [Types in USNM.] New synonymy.

This western North American species is not apt to be confused with any other of its congeners. In external appearances it is similar to *occidentalis*, also from the same localities, but differs from *occidentalis* not only in the arrangement of the teeth on the saw, but also by the entirely white clypeus. The male of this species can be separated from all other males by the form of the penis valve, fig. 34.

FEMALE.—Average length, 5.7 mm. General color black; clypeus, labrum, bases of mandibles, most of collar, tegulae, apices of coxae, posterior margins of abdominal segments, most of 9th abdominal sternite, and margin of sheath, white; legs, at least the apices of the femora, tibiae, and tarsi, tan.

Malar space moderately wide, hardly more than 1.5 times the width of the anterior tibial spur; clypeus slightly emarginate, just barely bulged; anal cell of hind wing with petiole vein; sheath rounded; saw heavily sclerotized and reduced, fig. 15.

MALE.—Average length, 4.7 mm. Color similar to female, often somewhat darker. Penis valve as in fig. 34.

Host.—Unknown.

Distribution Records.—Specimens examined, 36; 16 ♀, 20 ♂.

CALIFORNIA: 1 ♀; Carmel, Monterey Co.; March 24, 1919; E. P. Van Duzee; [INHS]. 3 ♀, 5 ♂; Claremont, C. F. Baker; [types of *leucostoma*, USNM]. 6 ♀, 15 ♂; Mill Valley, Marin Co.; February 14, 18, 20, 21, 26, 28, March 6, 1926; M. C. and E. P. Van Duzee; [ANSP, CAS, INHS]. 1 ♀; Oakland Hills, Alameda Co.; March 8, 1908; Van Dyke; [INHS]. 2 ♀; Pine Valley, San Diego Co.; April 24, 1920; E. P. Van Duzee; [INHS]. 1 ♂; Santa Clara Co.; Baker; [type of *bakeri*, MCUI]. 1 ♀; near Stanford University; Corte Madero Creek Canyon, lower end; April 4, 1915; Harold Morrison; [INHS].

Periclista occidentalis Rohwer (Figs. 13, 36.)

1909. *Periclista occidentalis* Rohwer, Can. Ent., XLI: 398–399. (3 ♀, 3 ♂.) [Types in USNM.]

In addition to the differences found in the genitalia, the black clypeus will help serve to separate this species from its nearest ally, *bakeri*.

FEMALE.—Average length, 5.7 mm. Color black; often tips of clypeus, labrum, posterior angles of collar, tegulae, occasionally areas of the mesoepisternum, frequently the posterior margins of abdominal segments, 9th abdominal sternite broadly, and margin of sheath, yellow to white; legs, except coxae, mostly tan.

Malar space moderately wide, about 1.5 times the width of the anterior tibial spur; clypeus very slightly emarginate, somewhat bulged; inner tooth of tarsal claw longer and heavier than in *bakeri;* sheath truncate or broadly rounded; anal cell of hind wing with petiole vein; saw as in fig. 13.

MALE.—Length, 4 mm. Slightly darker in color than female; hind wing without peripheral vein; penis valve as in fig. 36.

Host.—Quercus wislizenii.

Distribution Records.—Specimens examined, 23; 20 ♀, 3 ♂.

CALIFORNIA: 3 ♀, 3 ♂; Claremont; C. F. Baker; [type of *occidentalis*, USNM]. 6 ♀; Mill Valley, Marin Co.; February 21, 28, March 21, 1926, March 18, 1920; E. P. Van Duzee; [ANSP, CAS]. 2♀; Mt. Tamalpais, Marin Co.; March 14, 1909; E. C. Van Dyke; [CAS, INHS]. 1♀; Lagunitas, Marin Co.; April 26, 1924; E. P. Van Duzee; [INHS]. 3♀; Oakland Hills, Alameda Co.; March 8, 22, 1908; April 30, 1911; E. C. Van Dyke; [CAS, INHS]. 4♀; Oroville; March 5, 10, 1928; H. H. Keifer; ex: *Quercus wislizenii;* [CAS, INHS]. 1♀; Soquel Creek; Santa Cruz Co.; May 30, 1909; E. C. Van Dyke; [INHS].

Unplaced Nearctic Species

The two species listed here probably belong to the genus *Periclista,* but since I have not seen the types, I cannot place them with certainty in their proper subgenus or complex.

Periclista marginicollis (Norton)

1861. *Selandria marginicollis* Norton, Proc. Bost. Soc. Nat. Hist., VIII: 220. (♀.) [Type in MCZ (Harris Collection).]

1867. *Sclandria (Monophadnus) marginicollis* Norton, Trans. Am. Ent. Soc., I: 111. Redescription of ♀.

1894. *Monophadnus marginicollis* (Norton); Dalla Torre, Cat. Hymen., I: 163.

1908. *Periclista marginicollis* (Norton); MacGillivray, Can. Ent., XL: 291.

MacGillivray (1908), after studying the type specimen, placed this species in the genus *Periclista.* He further observed that *marginicollis* was "very similar in coloration to *Periclista purpuridorsum* Dyar." In the section of the *Hymenoptera of Connecticut* (1916) pertaining to the Tenthredinoidea, MacGillivray included *marginicollis* in his key to *Pcriclista.* According to Mr. William L. Brown, who has kindly examined the type for me, the stub of the anal vein of the forewing is upturned in the manner of the *Periclista.*

Periclista mutabilis Konow

1904. *Periclista mutabilis* Konow, Zeit. fur Syst. Hymen. und Dipt., VI: 241. (♂ & ♀.) Disposition of types unknown.

1909. *Periclista mutabilis* Konow; Rohwer, Can. Ent., XLI: 399. A misidentification, Rohwer, 1917, Proc. U. S. Nat. Mus., LIII: 154.

Undoubtedly a *Periclista,* this species might possibly be a synonym of *albicollis.* The original specimens were from Dallas, Texas.

Excluded Species

Ardis chionanthis (Dyar)

Originally described as *Periclista chionanthi* Dyar (1898, p. 132), this species is herewith transferred to the genus *Ardis*. Two females were designated as types in the description, "Coll. U. S. Nat. Mus. (Miss Murtfeldt), no. 296 M." and they were deposited in the United States National Museum. Examination of these types revealed that the female sawfly labeled "Type" in Dyar's handwriting was not a *Periclista* but instead a species of the genus *Ardis*. The other type, the paratype, was a female of the species *Periclista media*.

Inasmuch as *chionanthi* was described from two specimens so different from each other, and since the description of the larvae, which supposedly were like those that gave rise to the imagoes, was brief, it is difficult to decide whether Dyar's larvae belong to *Ardis chionanthi* or to *Periclista media*. Dr. Henry Townes reports, in a letter, that Dyar's rearing notes on this species are missing. In lieu of positive evidence, the host "white fringe (*Chionanthus*)," and the larval description should be regarded as questionable, at least until the larvae can be compared or until additional material can be reared.

Ardis chionanthi (Dyar) was listed under *Periclista* in the *Insects of North Carolina* (1938). The specimens upon which this report was made were restudied and found to be species of the genera *Monophadnoides* and *Monophadnus* and neither *Periclista* nor *Ardis*.

Pristiphora patchi (MacGillivray)

MacGillivray (1923) described this species as *Periclista patchi*, but Ross, in an unpublished manuscript, regards it as a species of *Pristiphora* in the subfamily Nematinae. The type is located in the MacGillivray Collection, University of Illinois.

Neocharactus californicus Rohwer

Since the genus *Neocharactus* has been combined with *Periclista* as a subgenus, it seems worthwhile to point out that *N. californicus* was one of the species *not* included in the transfer of names. The exclusion of this species from *Periclista* is emphasized because of the statements in the original description, that is, the expression of doubt in Rohwer's mind whether or not to place this species in the genus *Neocharactus.* His conjecture at that time, 1909, was that *californicus* agreed somewhat with *Periclista bakeri* and might be the female of the latter species.

The holotype, which was examined for me by Dr. Henry Townes, bears on the forewings a straight anal vein stub. Furthermore, the sheath is similar to that of *Blennocampa.* It is doubtful then that this unassigned species will ever be placed in *Periclista* and therefore it is not probable that the species name *Periclista californicus* Rohwer 1917 need ever be in jeopardy as a homonym.

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EXPLANATION OF FIGURES

PLATE II

Female Genitalia of Subgenus *Periclista*

Abbreviations used: dm—dorsal membrane of lancet.

Fig. 1.—*Periclista* (*Periclista*) *caryicola* (Dyar). Lance.

Fig. 2.—*Periclista* (*Periclista*) *diluta* (Cresson). Lancet.

Fig. 3.—*Periclista* (*Periclista*) *caryicola* (Dyar). Details of ventral teeth of lancet.

Fig. 4.—*Periclista* (*Periclista*) *sulfurana* new species. Details of ventral teeth of lancet.

Fig. 5.—*Periclista* (*Periclista*) *vergorba* new species. Lance.

Fig. 6.—*Periclista* (*Periclista*) *vergorba* new species. Lancet.

Fig. 7.—*Periclista* (*Periclista*) *vergorba* new species. Details of ventral teeth of lancet.

Fig. 8.—*Periclista* (*Periclista*) *media* (Norton). Lance.

Fig. 9.—*Periclista* (*Periclista*) *linea* new species. Lancet.

Fig. 10.—*Periclista* (*Periclista*) *naranga* new species. Details of ventral teeth of lancet.

Plate III

Female Genitalia of Subgenus *Neocharactus*

Abbreviations used: ct—ctenidium; sb—sub-basal tooth (or teeth); se—serrula.

Fig. 11.—*Periclista* (*Neocharactus*) *subtruncata* Dyar. Lance.
Fig. 12.—*Periclista* (*Neocharactus*) *subtruncata* Dyar. Lancet.
Fig. 13.—*Periclista* (*Neocharactus*) *occidentalis* Rohwer. Lancet.
Fig. 14.—*Periclista* (*Neocharactus*) *inaequidens* (Norton). Lancet.
Fig. 15.—*Periclista* (*Neocharactus*) *bakeri* (MacGillivray). Lancet.

Plate IV

Male Genitalia of *Periclista*

Abbreviations used: h—harpes; pp—parapenis; pv—penis valve.

Fig. 16.—*Periclista* (*Periclista*) *sulfurana* new species. Part of male genital capsule, primitively dorsal (abossicular) aspect.
Fig. 17.—*Periclista* (*Periclista*) *bipartita* (Cresson). Harpes.
Fig. 18.—*Periclista* (*Periclista*) *caryicola* (Dyar). Harpes.
Fig. 19.—*Periclista* (*Periclista*) *linea* new species. Harpes.
Fig. 20.—*Periclista* (*Periclista*) *californica* Rohwer. Harpes.
Fig. 21.—*Periclista* (*Periclista*) *electa* MacGillivray. Parapenis.
Fig. 22.—*Periclista* (*Periclista*) *media* (Norton). Parapenis.
Fig. 23.—*Periclista* (*Periclista*) *albicollis* (Norton). Parapenis.
Fig. 24.—*Periclista* (*Periclista*) *linea* new species. Parapenis.
Fig. 25.—*Periclista* (*Periclista*) *entella* MacGillivray. Parapenis.
Fig. 26.—*Periclista* (*Periclista*) *californica* Rohwer. Parapenis.

Plate V

Male Genitalia, Heads, and Sheaths of *Periclista*

Abbreviations used: A—abossicular margin; al—apical lip; as—apical spine; o—ossicular margin; va—valvispina.

Fig. 27.—*Periclista* (*Periclista*) *bipartita* (Cresson). Penis valve.
Fig. 28.—*Periclista* (*Periclista*) *caryicola* (Dyar). Penis valve.
Fig. 29.—*Periclista* (*Periclista*) *sulfurana* new species. Penis valve.
Fig. 30.—*Periclista* (*Periclista*) *spicula* new species. Penis valve.
Fig. 31.—*Periclista* (*Periclista*) *linea* new species. Penis valve.
Fig. 32.—*Periclista* (*Periclista*) *californica* Rohwer. Penis valve.
Fig. 33.—*Periclista* (*Periclista*) *electa* MacGillivray. Penis valve.
Fig. 34.—*Periclista* (*Neocharactus*) *bakeri* (MacGillivray). Penis valve.
Fig. 35.—*Periclista* (*Neocharactus*) *subtruncata* Dyar. Penis valve.
Fig. 36.—*Periclista* (*Neocharactus*) *occidentalis* Rohwer. Penis valve.
Fig. 37.—*Periclista* (*Periclista*) *caryicola* (Dyar). Part of face.
Fig. 38.—*Periclista* (*Periclista*) *electa* MacGillivray. Part of face.
Fig. 39.—*Periclista* (*Periclista*) *caryicola* (Dyar). Lateral aspect of sheath.
Fig. 40.—*Periclista* (*Periclista*) *diluta* (Cresson). Lateral aspect of sheath.

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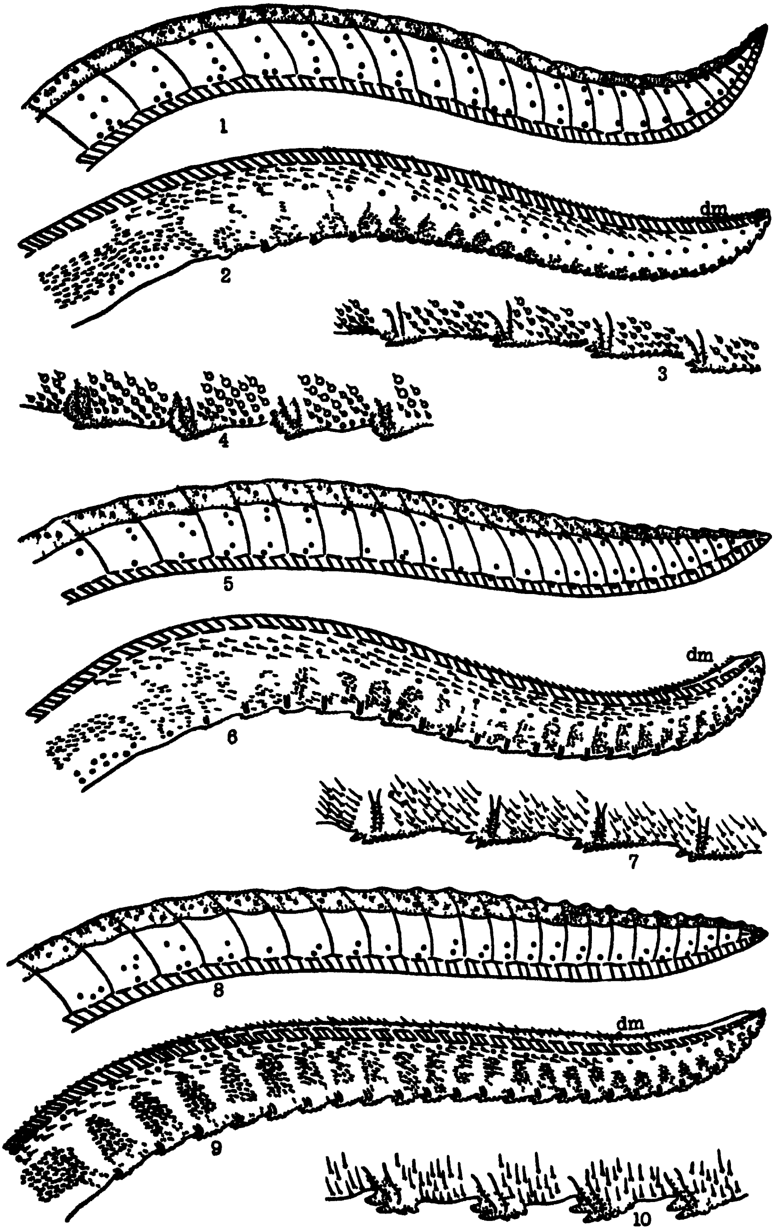
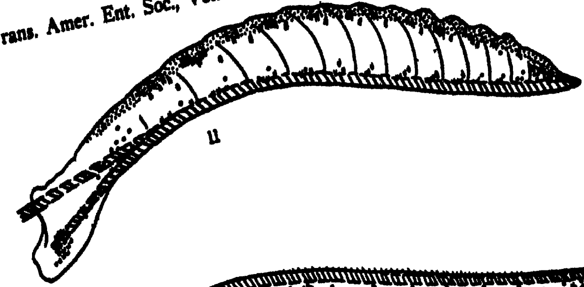


STANNARD—NEARCTIC PERICLISTA



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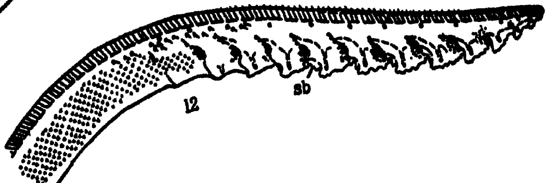

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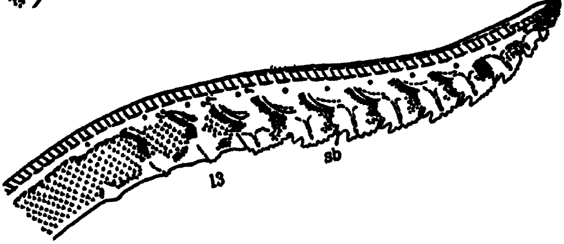

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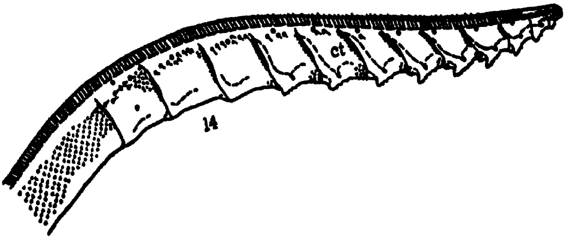

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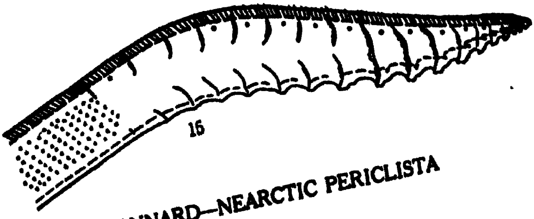

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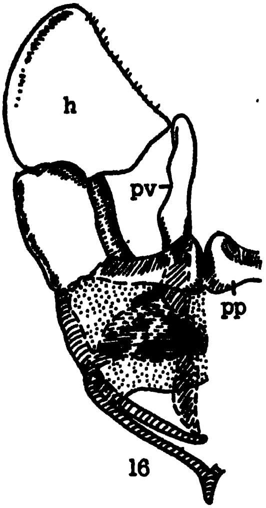

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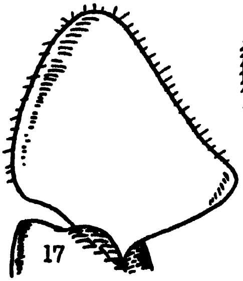

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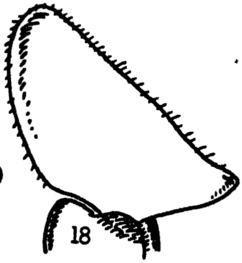

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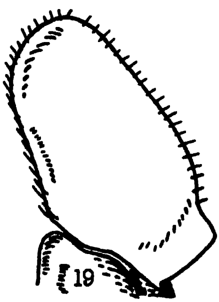

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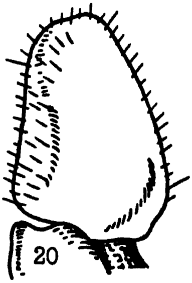

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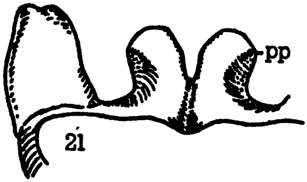

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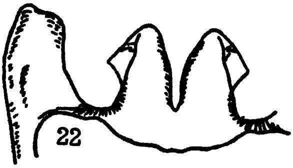

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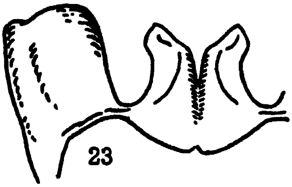

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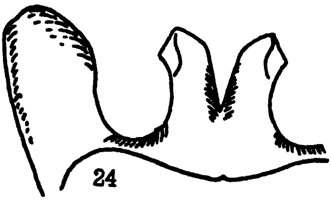

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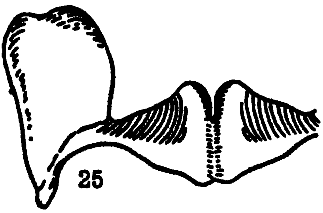

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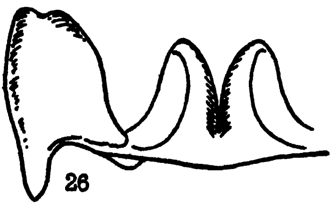

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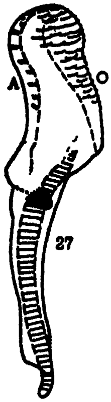
STANNARD—NEARCTIC PERICLISTA



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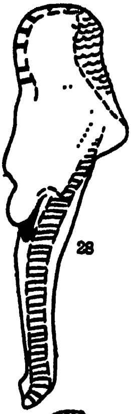

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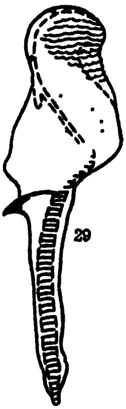

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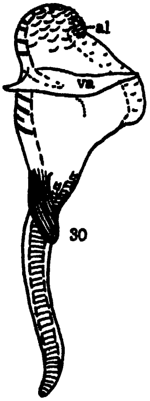

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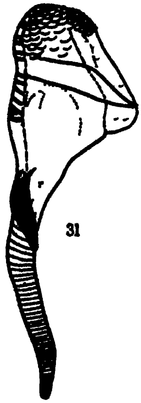

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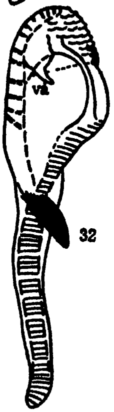

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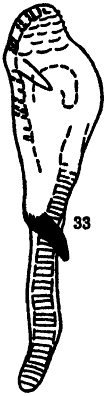

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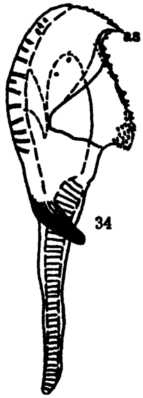

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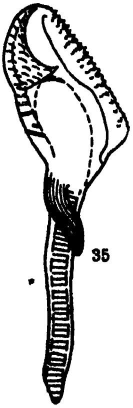

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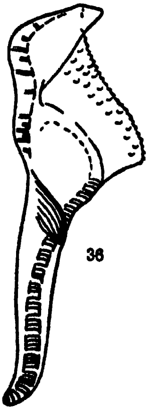

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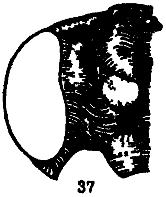

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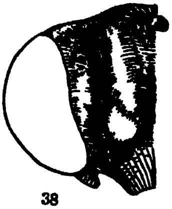

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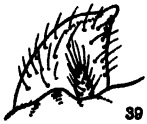

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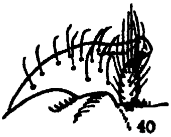

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STANNARD—NEARCTIC PERICLISTA

REVISION OF THE ANT TRIBE DACETINI: III.[1] EPITRITUS EMERY AND QUADRISTRUMA NEW GENUS

(HYMENOPTERA: FORMICIDAE)

BY WILLIAM L. BROWN, JR.

The Biological Laboratories, Harvard University

(Text-figure)

In my preliminary generic revision of the ant tribe Dacetini (1948) I showed that the ants with four antennal joints, formerly included in the genus *Epitritus* Emery, belonged in four separate genera representing unrelated phylogenetic lines. These genera were further discussed in a paper dealing with the group of genera around *Glamyromyrmex* Wheeler, now in press. The 1948 revision lists (p. 123) several forms under *Epitritus* in addition to *argiolus* Emery, the genotype, but I have since found that the genus must be restricted to *argiolus* alone of the known four-jointed forms. Though all these ants are closely similar in habitus, a detailed study of the mandibles and labral lobes show that *argiolus* is derived from a *Smithistruma*-like ancestor, while *emmae* Emery and probably *eurycerus* Emery are really only modified *Strumigenys*. Thus another monotypic genus is added to the long list already known within the dacetines; many of these monotypic genera, however, will prove to hold more species than just the single one, since my working collection contains new forms as yet undescribed which fit very well into several of them.

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[1] A preliminary paper to this series appeared in these Transactions, LXXIV, p. 101, 1948. Two other parts are in press in *Acta Soc. Lilloana* and in *Mushi*.

EPITRITUS Emery

1869. *Epitritus* Emery, Bull. Soc. Ent. Ital., I, p. 136.

WORKER.—Resembling in habitus the ants of the subgenus *Wessonistruma* of *Smithistruma* Brown, but the funiculus with only three joints and the mandibles lengthened and strongly deflected ventrally at their apices. Inner (masticatory) mandibular border terminated basally by a low, obtusely angular lamina; above this begins the basal border, which runs obliquely to the condyle, but which is hidden under the clypeus at full mandibular closure. The apex of the mandible does not bear a true apical fork, and the basic arrangement of the teeth is a serial one, though the greatly lengthened subapical spine and the downturned apical portion in *argiolus* together create a false fork of a sort. The pilosity is mostly squamiform as in *Wessonistruma* and many other dacetines. Size small, color varying degrees of ferrugineous. Labral lobes long.

FEMALE.—As long as or slightly longer than the worker, similar in form. but with the usual thoracic differences and a slightly more bulky gaster.

MALE.—Uncertainly associated with this species; see discussion below.

GENOTYPE.—*Epitritus argiolus* Emery, 1869, Bull. Soc. Ent. Ital., I, pp. 136–137, fig. 1, female, monobasic.

Contains, so far as is known, only the species *argiolus* from the Mediterranean area.

Epitritus argiolus Emery (Figure 1: a, b.)

1869. *Epitritus argiolus* Emery, Bull. Soc. Ent. Ital., I, pp. 136–137, fig. 1, female.

1875. *Epitritus argiolus* Emery, Ann. Mus. Civ. Stor. Nat. Genova, VII, p. 473, fig., worker.

1882. *Epitritus argiolus* Ern. André, Spec. Hymn. Eur., II, 402, Pl. 16, fig. 23, Pl. 25, figs. 13–17, 20, 21, worker, female, male.

1917. *Epitritus argiolus* Emery, Bull. Soc. Ent. Ital., XLVII, pp. 206–207, fig. 64, worker, female, male. (Emery gives 1917 as the date in his listing in Gen. Insect.: Hym., Fasc. 174, p 327, but this paper is marked '1916.')

1923. *Epitritus argiolus* var. *barbarus* Santschi, Bol. Soc. R. Esp. Hist. Nat., XXIII, p. 136, worker.

WORKER.—Best figured by Emery in 1917 (op. cit.) for head and mandibular characters. Specimens sent me by Sr. Mario Consani of Florence show the following measurements: maximum measurable length of head proper, 0.46 ± .005 mm., exposed length of mandibles, 0.18 ± .003 mm., length of alitrunk, 0.50 ± .01 mm., total length, 2.05–2.15 mm., cephalic index, 92–93, mandibulo-cephalic index, 39–40. (Two specimens taken at Ancona by Dr. A. Andreini.) I have also seen four specimens in the collection of Dr. W. M. Mann which agreed closely with my specimens. Emery, who had a considerable number of specimens before him in 1917, gave the range of the length in the worker as 1.8–2.2 mm.

The mandibles, just distad of the long, sharp subapical spinelike tooth which each bears on its inner border, are slightly thickened and bent sharply ventrad and somewhat posteriorly, so that in side view they resemble a stout, slightly recurved hook protruding from the mouth region. The masticatory border of each recurved apical section bears six or so minute, serially arranged denticles, the apicalmost being larger, more acute and toothlike. Basad of the long spine, each mandible bears on its inner border four small, separated, serially arranged acute teeth which alternate shorter-longer, beginning just basad of the spine with a shorter one. Emery shows this more or less correctly in his figure (1917, fig. 64), but the dentition is best shown on the right mandible, while that of the left is obscure and sketchy. Basad from these are several spatulate hairs.

The long labral lobes and the angulate anterolateral borders of the occipital lobes are shown clearly in Emery's figure just cited, but my specimens have the antennal scapes slightly more incrassate. The cephalic hairs are much like those on the dorsum of the head of *Smithistruma pergandei;* that is, with a short petiole and a suborbicularly flattened apical portion bent at right angles to the petiole so as to lie parallel with and close to the integumental surface.

Other characters which have received little notice in former descriptions and figures are noted for my specimens and those in the Mann collection: The mandibles with a basal border running obliquely under the clypeus at full closure, this border separated from the apical (inner or masticatory) border by an obtuse angle probably representing a reduced basal tooth. The apical border has two margins, an upper or dorsal and a lower one; the prespinal teeth and denticles and the long spiniform tooth itself borne on the dorsal of these two margins; the space between these margins in the form of a shallow convex groove with a median ridge.

Pronotum depressed above and nearly plane, but not definitely marginate laterally. The mesonotum drops off rather suddenly at its rounded posterior border to meet the dorsum (base) of the propodeum, the latter sloping sharply (at an angle of 45° from the general dorsal thoracic plane) to meet the vertical propodeal declivity. Propodeal teeth very small but rather acute, each subtended ventrally by a thin lamella which is slightly widened ventrally. Alitrunk in profile very weakly convex from the anterior pronotal margin to the posterior mesonotal margin

Petiole with a fairly long, anteriorly tapering peduncle, node seen from above globular, only half as long and less than half as wide as the postpetiolar node, its spongiform appendages obsolete. Postpetiolar node transverse-oval, relatively bulky, with only a rather sparse growth of spongiform appendages, and these restricted to the posterior borders.

Hairs on dorsum of alitrunk and of the two nodes extremely few and scattered, squamiform to varying degrees; gastric dorsum with scattered, fine, short, erect hairs, most of which are weakly flattened at their tips.

Sculpture of head and alitrunk minutely punctulate-granulose, much like that of ordinary *Smithistruma* and *Strumigenys* species; nodes also similar, appearing opaque to subopaque; basal costulae of first gastric segment few and widely spaced, long on the sides and shorter in the middle; first gastric segment dorsally with what appears to be faint pebble-shagreening, but rather strongly shining. This effect may be due to a thin coat of the secretions with which dacetines often cover themselves, but there definitely seems to be some sort of feeble sculpture present, at least in the Ancona specimens.

Color yellowish to medium ferrugineous.

FEMALE.—Emery gives the total length as 2.2 mm. and the length without the mandibles as 2 mm. and describes the alitrunk as "subtilius, longitudinaliter coriaceo-rugulosus." There appears to be little or no difference in proportion between the female and large workers except the usual ones in the case of thoracic development and possibly in the greater bulk of the gaster.

MALE.—The male which André associated with this species has not, to my knowledge, actually been taken with workers or females. It could be the male of *Smithistruma baudueri,* with which another male has been uncertainly identified, or of *Trichoscapa membranifera,* for which no male is known, or it could belong to an undescribed dacetine species, the workers or females of which have not yet been found. I refer those who wish to speculate on the relationships of the males to the references given above in the synonymy.

I have synonymized Santschi's variety *barbarus* because of his very feeble differentiating characters, based on a single small specimen from Tunisia as compared with Italian specimens from what was apparently a single collection. Since Emery had already (1917) determined some typical *argiolus* from Tunisia, I can see no reason for considering his small specimen as a geographical race.

Range.—(According to Emery): *Type locality*—"in graminibus . . . ad *S. Concordio di Moriano* in agro Lucensi." Insular and continental Italy, Southern France, Pantelleria, Tunisia, Hungary.

This species probably occurs at many points on the shores of the Mediterranean.

Biology.—Apparently this species accepts drier and more open situations than do most other dacetines; in this respect *argiolus* seems to be similar to *Smithistruma baudueri* and *Trichoscapa membranifera,* which apparently have similar ranges in the Mediterranean area. It would not be surprising if *argiolus* were found to occur in southeastern North America or other New World localities with a warm, dry climate. No observations on the feeding habits of this species have been reported. Emery states that the nests are small and "subterranean." The male linked doubtfully with this species was taken separately in August.

QUADRISTRUMA new genus

1890. *Epitritus* Emery, *sensu* Emery, Bull. Soc. Ent. Ital., XXII, p. 70, part.
1893–1948. *Epitritus* Emery, authors, part.

WORKER AND FEMALE.—Small ants with three funicular segments, superficially resembling *Epitritus*, but with a true apical fork of two spiniform teeth and a small posteriorly directed basal lobe on the mandible as in *Strumigenys*. Labral lobes very short and inconspicuous, the triggers or trigger-hairs set laterally to them and diverging widely anteriorly; labrum acutely cornuate on each anterolateral angle. Pilosity and sculpture much as in the majority of *Smithistruma* and *Strumigenys* species.

MALE.—Unknown.

GENOTYPE.—*Epitritus emmae* Emery. Bull. Soc. Ent. Ital., XXII, p. 70, Pl. 8, fig. 6, worker, by present designation.

This genus is understood to include, besides the genotype, the species *eurycera* (Emery), which was formerly included in *Epitritus*.

Quadristruma emmae ranges over a great part of the earth's tropics and subtropics in scattered localities.

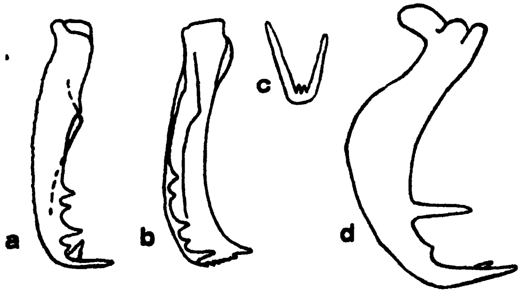

Figure 1.—Mandibles, *a* dorsal view, *b* medial view, *Epitritus argiolus* Emery, Arezzo, Italy. *c* apical fork, *d* dorsal view, *Quadristruma emmae* (Emery), Soledad, Cuba. Both from workers.

Quadristruma emmae [2] (Emery) (Figure 1: c, d.)

1890. *Epitritus emmae* Emery, Bull. Soc. Ent. Ital., XXII, p. 70, Pl. 8, fig. 6, worker.

1897. *Epitritus emmae* Emery, Term. Füzetek, XX, p. 581, worker.

1908. *Epitritus emmae* Wheeler, Bull. Amer. Mus. Nat. Hist., XXIV, p. 149, female.

1909. *Epitritus clypeatus* Szabo, Arch. Zool. (Budapest), I (7), p. 1, fig. 1, worker.

1913. *Epitritus clypeatus* var. *malesiana* Forel, Zool. Jahrb. Syst., XXXVI, pp. 83–84, worker, female.

1916. *Epitritus wheeleri* Donisthorpe, Ent. Record, XXVIII, p. 121, worker.

This species has been described so many times, and figured as well, that a formal description would be superfluous. Only the worker and female are known, the female being slightly the larger of the two forms, with the usual thoracic differences and a slightly larger gaster. Otherwise, the female is quite similar in proportions of the head and mandibles.

Szabó was led to describe *clypeatus* because of differences he found in New Guinea specimens which had previously been determined as *emmae* by Emery. Szabó compared these specimens with Emery's 1890 figure of *emmae* and pronounced his new species as distinct from it on the basis of supposed differences in length of clypeus, form of antennal scape, and general size. Forel and Donisthorpe then described *malesiana* (Sumatra) and *wheeleri* (Hawaii) as forms intermediate between *emmae* and *clypeatus* in these very same characters! Although I have not seen the type of *emmae*, I believe that it is identical with *clypeatus* for the following reasons:

(1) Emery originally identified the specimens used as the types for *clypeatus* as his *emmae*, they differing only slightly in size from the St. Thomas specimens.

(2) Plates 7 and 8 of Emery's 1890 paper contain figures of several other dacetine species which I know to be seriously in

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[2] After sending this paper off to press, I received two series of *Quadristruma emmae* from Dr. J. W. Chapman of the Silliman Institute. One lot was labelled simply "Philippines, Domingo Empeso," while the other was taken by Dr. Chapman at Dumaguete, Negros, Philippine Islands. Dr. Chapman also says that he has taken an "*Epitritus*" on another occasion in a graveyard at Dumaguete. So far as I can tell, there are no previous records from the Philippines.

error, so it seems safe to assume that the drawings, including that of *emmae,* were carelessly and hastily executed.

(3) The heads of several specimens tilted slightly out of the horizontal viewing plane gave outlines much the same as those of the original figure of *emmae;* these specimens were Hawaiian in origin.

(4) Cuban, Porto Rican and Dutch Guianan specimens of this form's New World populations were compared with Hawaiian specimens; no differences worth mentioning were found, either in size or details of form. These specimens agreed better with Szabó's figure of *clypeatus* than with any other figure listed in the synonymy, including that of *emmae* mentioned in (2) above.

(5) The records of distribution for *emmae* and its synonyms are distinctly indicative of tropicopolitan tramp habits like those of *Trichoscapa membranifera* Emery, thus destroying any arguments for validity of the synonyms on a basis of geographical isolation. Most of the records are from seaports or other coastal localities.

If *clypeatus* is a synonym of *emmae,* the forms *malesiana* and *wheeleri* must also be synonyms; anyone desiring confirmation of this fact has but to read the original descriptions of these forms, keeping in mind the considerations outlined above.

Workers of *emmae* from Hawaii, Cuba, and Porto Rico show the following measurements and proportions: total length, including mandibles, 1.4–1.8 mm., length of head proper 0.40–0.44 mm., cephalic index 77–83, mandibulo-cephalic index 28–30; based on 7 specimens.

Females from Cuba, Hawaii, and Paramaribo show the following: total length 1.8–2.1 mm., length of head proper 0.46–0.49 mm., cephalic index 81–85, mandibulo-cephalic index 28–32; based on four specimens.

The mandibles are strongly bowed and possess an apical fork of two long spiniform teeth, the dorsal of the pair nearly half again the length of the ventral; inner border adjacent to the condyle with a small, rounded lobe which points inwardly and somewhat posteriorly when the mandibles are closed, this lobe completely concealed except when the mandible is opened to nearly full extent; subapical tooth stout and acutely spiniform, situated between the midlength and the apex of the inner border. Some specimens seem to have a small, indistinct denticle on the inner border in the space between the apical and subapical teeth; this tubercle, when present, is very difficult to see because of the hairs which obscure it. It seems not to be corrėlated in any way with distributional patterns. Two acute denticles between the two teeth of the apical fork.

Range.—Type locality (according to Emery), St. Thomas. Other reliable records include the following, the asterisks (*) indicating that I have examined specimens:

Hawaiian Islands: Oahu, *teste* Donisthorpe, as *wheeleri*. Oahu (without collector), det M. R. Smith *. Waimanaloa, Oahu (Swezey) *.

Guam: Oca Point (G. Wharton), det. M. R. Smith *.

United States: Miami, Florida (W. Buren), teste M. R. Smith.

Porto Rico: Arecibo (M. R. Smith), det. M. R. Smith *. Ensenada (M. R. Smith), det. M R. Smith *.

St. Vincent: Dry River, near sea (H. H. Smith), teste Forel.

Cuba: Havana (C. F. Baker), det. Wheeler *. Soledad (F. G. Walsingham), det. Weber *.

Dutch Guiana: Paramaribo (Buenzli) *.

Sumatra: Soengei Bamban (Buttel-Reepen), described by Forel as *clypeatus* var. *malesiana*.

Singapore: (L. Biró), described by Szabó as *clypeatus*.

New Guinea: Lemien, near Berlinhafen (L. Biró), determined as *emmae* by Emery, described as *clypeatus* by Szabó.

Biology.—Nothing is known of the food preferences. Many of the collecting records are of single females taken under objects lying on sea beaches; workers have been taken with the sieve and Berlese funnel in both forested and agricultural areas, usually near the sea. This ant seems to show tolerance for a wider range of environmental conditions than most dacetines. My guess is that the original range of this species lay in the Indomalayan-Papuan regions, since it seems adventitious in most of the other recorded localities, and since *Q. eurycera*, which is clearly related, is from the mainland of New Guinea.

Quadristruma eurycera (Emery)

1897. *Epitritus eurycerus* Emery, Term. Fuzetek, xx, p. 581, Pl. 14, fig. 17, worker.

1922. *Epitritus eurycerus* Emery, Gen. Insect.: Hym., Fasc. 174, p. 327, Pl. 7, fig. 7, worker.

I have not seen specimens of this ant, which has not been taken since the type collection. Emery's short description gives the length as "1½–1½" (*sic!*) mm., and his figure portrays the head as in the neighborhood of cephalic index 90 and mandibulo-cephalic index about 30 or 31. The mandibles are very slender and rather straight, with two long equal or subequal spiniform teeth forming an apical fork, plus a single short spiniform tooth at about the apical third of the inner border. By far the most striking character, and one which separates *eurycera* from all other ants I have seen or seen figures of, is the amazingly extreme incrassation of the antennal scapes. These members form nearly equilateral triangles of an apparently lamellar nature, the total surface area of each exceeding the area of the entire clypeal disc! Of the thorax, Emery says, "Thorax suturis impressis, pronoto medio depressione longitudinale." And of other features, ". . . epinoti dentibus acutis. Petioli segmentum 1 nodo subrotundo, 2 transversim ovale, postice et lateribus margine spongioso."

And, "fusco-testacea . . . creberrime punctulata, opaca, gaster nitida, basi striatula; squamulis minutissimis, parce conspersa . . . clypeo antice arcuato." Only the worker caste is known.

Range.—Known only from *type locality:* "E silva *Lemien*, prope *Berlinhafen* . . ." (L. Biró), in what was formerly German New Guinea.

Biology.—Nothing known.

The types of *Epitritus argiolus*, *Quadristruma emmae* and *Q. eurycera* presumably rest in the collection of the late Prof. Carlo Emery either at Bologna or Genoa

I wish to thank the following persons for aid in the matter of loans of specimens: Dr. M. R. Smith, Sr. Mario Consani and Dr. J. C. Bequaert of the Museum of Comparative Zoology; the checking of many of the original references is to be credited to my wife, Doris Evelyn Brown.

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THE LYCIDAE OF THE UNITED STATES AND CANADA

I. THE TRIBE LYCINI

(COLEOPTERA)

BY JOHN WAGENER GREEN

Easton, Pennsylvania

(Text-figures)

This study was begun as an attempt to segregate and to identify, as far as it might be possible to do so, our numerous species of the genus *Plateros*. It soon became apparent from an examination of the ample material available that a review of all the Nearctic lycid genera would be advisable. The present paper is the first of a series whose purpose is to make known the new species that have accumulated in collections, and facilitate the recognition of all previously described species by means of revised synoptic tables and descriptions, including with the latter certain interesting and heretofore unrecorded details of morphology.

The *Lycidae* are divided into the following two subfamilies, of which only the second is represented in the American fauna.

Key to Subfamilies

Abdomen with six visible sternites in both sexes; femoral insertion oblique, extending toward base of the trochanter; pronotum not produced over the head...HOMOLISINAE

Abdomen with eight visible sternites in the male, seven in the female; femora arising apically from the trochanters; pronotum more or less produced over the head.....................................LYCINAE

The Lycinae may be defined as diurnal soft bodied beetles having the head partly covered by the pronotum, antennae 11-jointed, anterior coxae conical and prominent, middle coxae separated and oblique, posterior coxae contiguous and transverse, metepisterna not sinuate on the inner side, abdomen with eight visible sternites in the male and seven in the female, epipleura wanting, trochanters intervening between coxae and femora, the femoral insertion distal, tarsi 5-jointed, claws simple (except in the oriental *Macrolycus*).

The tarsal structure is quite uniform throughout in the Lycinae. The fourth segment is cordiform but not emarginate, the fifth arising sub-basally from a dorsal excavation of the fourth. The third segment is similar to the fourth but less deeply excavated. The first four segments are provided beneath in both sexes with apical pads of dense short pubescence.

The elytra have normally four discal costae; that nearest the suture is designated the first, and the one nearest the lateral margin the fourth or humeral costa. The costae vary in development and may be in part or entirely obliterated. The costal intervals may have either one or two rows of cells, also varying in development from distinctly quadrangular to irregular punctiform impressions.

As in previous papers, the abdominal sternites are numbered to correspond with their tergites, beginning at the base. The first visible sternite is number 2, tergite 1 having no corresponding sternite. Measurements of the length of the body are taken from the anterior margin of the pronotum to the tip of the elytra. In those species with the head rostrate measurement of the length of the beak is taken from the anterior margin of the eyes to the apex of the clypeus. The ratio between the length of the beak and the distance between the eyes, taken at the mid-point in their length, provides a convenient means for comparison of the rostral structure.

The identification of most of the species of *Plateros* is possible only by an examination of the male genitalia. A technique that has been found satisfactory in the extraction of the genitalia from cabinet specimens of *Lycidae* and *Lampyridae* is here described. If carefully carried out it will result in no visible damage to the specimen.

The implements required are a binocular microscope of low power, about 15 ×, a dissecting needle made by grinding a large needle to a chisel point and mounting in a wooden handle, a small camels hair brush, and a finely pointed forceps. Ten to fifteen hours in a relaxing jar will soften the beetles sufficiently; if relaxed too much they will be found more difficult to manipulate. Under the microscope the abdomen is grasped securely with the forceps and the dissecting needle used to sever the lateral connecting membrane of sternites 6, 7, and 8. It is best to begin the operation at the side of sternite 8, allowing the ninth segment containing the genital apparatus to remain in place. When the three sternites have been completely loosened, but not detached from sternite 5, they are folded back, exposing the ninth segment which is then split along one side and the genitalia removed. If the integuments are kept moist during the dissecting process there will be little danger of injury. The folded sternites are floated back with an excess of water, and will remain in their natural position because of the adhesive quality of the body contents. The genitalia may be glued to a triangle to be mounted on the same pin as the beetle, using the moistened camels hair brush to pick up and manipulate these small parts. If mounted in an upright position an unobstructed view from three sides may be obtained.

The material on which the present series is based was drawn from the following institutions and individuals, to all of whom the author wishes to express his sincere thanks and appreciation: Academy of Natural Sciences of Philadelphia, American Museum of Natural History, California Academy of Sciences, Cornell University, Emory University, Illinois State Natural History Survey, North Carolina Department of Agriculture, Ohio State University, Oregon State College, Reading Public Museum, South Dakota State College, University of California, University of Idaho, University of Ohio, Carl Cook, W. S. Craig, C. A. Frost, R. R. Dreisbach, S. D. Hicks, E. J. F. Marx, Borys Malkin, A. T. McClay, F. H. Parker, Rev. Bernard Rotger, G. Stace Smith, Bruce Summerville, and F. N. Young.

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Lycinae—Key to Nearctic Tribes

1. Front horizontal, mouth anterior; scutellum not emarginate..........2
   Front deflexed, mouth inferior; scutellum usually emarginate at apex...3
2. Anterior thoracic spiracles prominently tubulate; pronotum without oblique lateral elevations; elytra costate and reticulate with raised lines, the fourth discal costa prominently cariniform at the humerus. Head rostrate. (Contains *Lycus* Fabricius only)................LYCINI
   Anterior thoracic spiracles not prominent; pronotum with an oblique elevation each side, joining the lateral margin near the posterior angle; elytra not reticulate, costae feeble, fourth discal costa obliterated basally..LYGISTOPTERINI

3. Antennae and legs only moderately compressed; antennal pubescence longer and somewhat bristling, especially in the male, second joint not transverse; anterior thoracic spiracles not prominent; anterior coxae contiguous or nearly so................................PLATERODINI

Antennae and legs strongly compressed; antennae with short decumbent pubescence, second joint transverse, very short and inconspicuous, nearly concealed in the apex of the first joint; anterior thoracic spiracles usually prominent; anterior coxae usually separated......CALOPTERINI

Tribe LYCINI

LYCUS Fabricius

1787. *Lycus* Fabricius, Mantissa Insectorum, Hafniae, I, p. 163.

1861. *Lycostomus* Motschulsky (subgenus), Bull. Mosc., XXXIV, part I, p. 136.

1881. *Rhyncheros* Leconte, Trans. Amer. Ent. Soc., IX, p. 18.

1883. *Neolycus* Bourgeois (subgenus), Ann. Ent. Soc. France, series 6, III, Bull. p. LXI.

Eyes small, distant; antennae approximate, moderately compressed, less than half as long as the body, rather densely clothed with very short prostrate pubescence, second joint short and transverse, third elongate; front not deflexed, produced in a beak, mouth anterior; mandibles very small, nearly straight, arcuate apically, not or scarcely extending beyond the clypeus, their tips distant when the mandibles are closed; clypeus free, subquadrate or somewhat transverse, apex not emarginate; palpi small, not broadly dilated. Pronotum transverse, widest at base, roughly pentagonal, apex produced in a very short subtriangular lobe, anterior angles variable, extending forward when prominent; sides broadly explanate and reflexed, without oblique elevations, median line briefly carinate at apex, thence more or less distinctly channeled nearly to base; anterior thoracic spiracles prominently tubulate; anterior coxae closely approximate. Elytra with four feebly elevated narrow discal costae, the third less distinct, the fourth very prominent at the humerus; intervals reticulate with irregular and transverse raised lines.

Except in *lateralis,* and to some extent in *lecontei,* the apical angles of all the abdominal sternites but the last are somewhat acutely produced posteriorly in both sexes. The apical angles are very strongly produced in sternite 8 of the male, forming a deep and broad emargination that is usually more deeply angulate medially. Sternite 8 of the female is notched at apex, and has, in all our species except *lateralis,* a strong subapical sinus each side limited anteriorly by an abrupt angulation of the margin. This formation, however, is quite unstable and varies considerably within specific limits. In the males the front and middle tibiae are slightly and obliquely produced at apex in a blunt point, a modification that is prominent in some species, becoming barely perceptible in others, and totally lacking in *lateralis.*

Key to Nearctic Subgenera and Species

1. Prosternum compresso-carinate; mesosternum protuberant; inner angle of metacoxae somewhat prominent posteriorly; trochanters of male unmodified..2

Prosternum and mesosternum unmodified; inner angle of metacoxae not produced; trochanters of male spinose. **Lyconotus** new subgenus 13

2. Metatibial spurs dissimilar, the inner acute, the outer slightly broader apically and bluntly rounded; elytra dilated in the male, with apical black spot...........Subgenus **Neolycus** Bourgeois 3

Metatibial spurs similar, acute; elytra not or scarcely dilated in the male.......................Subgenus **Lycostomus** Motschulsky 5

3. Elytra broadly dilated in the male, fulvous......................4

Elytra moderately dilated in the male, usually rufous or scarlet, rarely fulvous..............................**lecontei** new name

4. Maxillary palpi comparatively stout, distinctly wider apically; beak shorter, its length not more than twice the distance between the eyes. Anterior margin of apical elytral spot not notched where the humeral costa enters it; tips of femora black. **arizonensis** new species

Maxillary palpi slender, not distinctly wider apically; beak longer and more slender, its length more than twice the distance between the eyes. Anterior margin of apical elytral spot usually notched where the humeral costa enters it; femora usually entirely fulvous.......... ....**fernandezi** Duges

5. Elytra bicolored, with apical or basal dark area..... 6

Elytra unicolorous, fulvous or flavate..........................7

6. Elytra distinctly pubescent, rufous with a dark scutellar spot. **sanguinipennis** Say

Elytra virtually glabrous, rufous or scarlet with apical black spot. **sanguineus** Gorham

7. Pronotum pale with median dark spot, disk alutaceous; ventral surface mostly black..8

Pronotum entirely pale, shining; ventral surface usually entirely pale, the metasternum rarely black, abdomen sometimes with indistinct dark areas.......................................9

8. Legs entirely black............................**fulvellus** Leconte

Femora fulvous...................subspecies **femoratus** Schaeffer

9. Antennae entirely black; pronotum distinctly pubescent. **rubescens** Schaeffer

Base of antennae pale; pronotum subglabrous or with very sparse inconspicuous hairs...10

10. Pubescence of prosternal crest and mesosternal protuberance unmodified in the male; elytra of female distinctly, but sparsely and irregularly, pubescent, the hairs suberect and nearly straight. Size small, usually under 10 mm. in length.....**sagittatus** new species

Pubescence of prosternal crest and mesosternal protuberance longer and denser in the male, the hairs suberect and straight with their tips curved; elytra of female subglabrous, or with very sparse minute hairs that are decumbent and arcuate................11

11. Beak short and stout..12

Beak long and slender..........................**loripes** Chevrolat

12. Size small, less than 10 mm. in length; antennae with usually only the first joint entirely pale; aedeagus, viewed from above or below, hastate, with acute lateral barbs.............**minutus** new species

Size larger, length usually over 10 mm.; antennae with the first three joints entirely pale; aedeagus without lateral barbs.
simulans Schaeffer

13. Black, sides of pronotum and large humeral area of elytra fulvous.
lateralis Melsheimer

Lycus arizonensis new species (Fig. 1.)

Fulvous; elytra in about apical fourth or less, head, antennae, palpi, tips of femora, tibiae and tarsi black; scutellum rarely dark. The anterior margin of the apical elytral spot is arcuately oblique with the convexity forward, approaching nearest to apex at the suture, and is not notched where the humeral costa enters it. The underside of the first antennal joint, ventral surface of the beak, and its dorsal surface toward base are usually more or less rufescent; rarely the head and beak are entirely pale. Rather densely clothed above and beneath with short prostrate fulvous hairs, the elytral pubescence very short. Length 13–18.5 mm.

MALE. Head transversely impressed behind the antennal prominence; beak nearly twice as long as the distance between the eyes; maxillary palpi rather stout, distinctly broader apically; antennae feebly serrate, third joint nearly as long as four and five combined.

Pronotum with the lateral margins subparallel or very feebly converging from base to middle, thence arcuately converging to the triangular apical lobe, the anterior angles sometimes indicated by an abrupt change in curvature; median line strongly compresso-carinate in apical fifth, thence vaguely channeled to basal fifth.

Elytra broadly dilated, widest behind the middle where they are conjointly one-fourth to one-third longer than wide and two and one-half times as wide as the pronotum; surface finely punctate, reticulating lines very sparse or absent basally, becoming rather dense apcially, forming usually a double row of irregular cells on the costal intervals.

Prosternum compresso-carinate; mesosternum very strongly protuberant, the summit concave with the sides prominent; ventral pubescence not sexually modified. Apical angles of abdominal sternites produced posteriorly, more strongly toward apex. Tibiae distinctly arcuate, the posterior less strongly; metatibial spurs dissimilar, the inner acute, the outer slightly broader apically and bluntly rounded.

FEMALE. Differs from the male in having the elytra moderately dilated, at their widest point they are conjointly at least one-half longer than wide; mesosternum less strongly protuberant, the summit broader; tibiae scarcely arcuate.

Holotype.—Male; Pinal Mts., Arizona, July 20, 1947, collected by Frank H. Parker; located in collection of Academy of Natural Sciences of Philadelphia.

Allotype.—Female; same data and location as holotype.

Paratypes.—ARIZONA: Santa Catalina Mts., Sabino and Sycamore Canyons, VII–22 to VIII–20; Santa Rita Mts., VII–4 to 20; Huachuca Mts., Ramsay and Carr Canyons, Apache Camp, VI–23 to VII–25; Pinal Mts., VI–1 to VIII–3; Chiricahua Mts., Cave Creek, VI–29 to VII–20; Sierra Ancha Mts., Gila County; Tucson; Patagonia, VII–5 to 30; Oracle, VI–30 to VII–27; Bonita, VII–12; Harshaw, VIII–17; Palmerlee, VII–20; Nogales, Mt. Washington, 6000 ft., VII–17; Fort Grant, VII–19; Texas Pass, VII–20.

The paratypes (150) are distributed in the collections of Academy of Natural Sciences of Philadelphia, American Museum of Natural History, California Academy of Sciences, Cornell University, Ohio State University, F. H. Parker, C. A. Frost, and the author.

This species has heretofore been confused with the very similar *fernandezi*, occurring in the same territory. It is easily distinguished from Arizona examples of *fernandezi* by the absence of a notch in the anterior margin of the apical elytral spot where the humeral costa enters it, and by having the tips of the femora black. Examples of *fernandezi* from Texas and New Mexico usually simulate *arizonensis* in color pattern by having the notch of the elytral spot indistinct and the tips of the femora fuscous or black, but they may be recognized as *fernandezi* by the more slender beak and palpi. The two species differ quite definitely in the male genitalia. One example of *arizonensis* from "Exerter, Calif." and another from "Mont." were the only specimens seen without Arizona labels, and the records are in all probability erroneous.

Lycus fernandezi Duges (Fig. 2.)

1878. *Lycus fernandezi* Duges, La Naturaleza, IV, p. 175.

Fulvous; elytra in about apical fourth or more, antennae except at extreme base, palpi, clypeus, tibiae and tarsi black; color of head varying to entirely black. Anterior margin of apical elytral spot usually distinctly notched where the humeral costa enters it. Specimens from Texas and New Mexico have the notch of the elytral spot often indistinct or absent, the spot itself sometimes reduced in size, and the tips of the femora dusky or black. Vestiture and sculpture as in *arizonensis;* differing structurally by having the beak longer and more slender, its length about two and one-fourth times the distance between the eyes; maxillary palpi more slender, not distinctly wider apically; lateral margins of pronotum usually arcuately converging from base to apical lobe, the anterior angles obliterated. Elytra broadly dilated in the male, less so in the female; metatibial spurs dissimilar. Length 10–18 mm.

ARIZONA: Globe, VII–13 to VIII–23; Oracle, VII–11; Clifton, VIII–11; Baboquivari Mts., near Kits Peak, VIII–7; Pinal Mts., 4000 ft., VIII 3; Douglas, VIII–1 to 25.

NEW MEXICO: Carlsbad, VII–26; Alamogordo, Otero County, VII–13.

TEXAS: Cameron, IV–27; Austin, V–2 to 21; Kingsville, V–4; San Antonio; El Paso, VI–29; Davis Mts., VII–1; Chisos Mts, Brewster County, VII–4 to 17.

Lycus lecontei new name (Fig. 3.)

1861. *Lycus cruentus* || Leconte, Proc. Acad. Nat. Sci. Phila., XIII, p. 336.

Rufous or scarlet, rarely fulvous; elytra in about apical third, head, antennae, palpi, tibiae and tarsi black; head and first antennal joint varying to largely rufous; anterior margin of apical elytral spot not notched where the humeral costa enters it. Vestiture and sculpture as in *arizonensis* and *fernandezi;* beak nearly twice as long as the distance between the eyes; palpi slender, not distinctly wider apically; mesosternum of male less strongly protuberant; elytra of male moderately dilated, conjointly about three-fifths longer than wide, of female twice as long as wide; metatibial spurs dissimilar; apical angles of abdominal sternites, except 7 and 8, usually feebly produced, sometimes scarcely so. Length 7–13 mm.

LOWER CALIFORNIA: San Borjas, X–14; San Ignacio, 15 mi. N., IX–29; San Augustine, 20 mi. W., IX–24; San Jose del Cabo; Cape San Lucas.

ARIZONA: Florence, VI–5; Serritas, Black Dike, VII–26; Cave Creek, Maricopa County, IX–7; Tucson, VII–27; San Carlos, IX–3; Catalina Mts., VIII–5; Tempe.

Leconte[1] called attention to the fact that his *cruentus* is a homonym of *Lycus cruentus* Fabricius,[2] described from Sumatra, without providing a substitute. Although the Fabrician species unaccountably does not appear in recent literature, it nevertheless invalidates any subsequent use of the same combination of names.

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[1] Trans. Amer. Ent. Soc., 1881, IX, p. 63.

[2] Syst. Eleuth., 1801, II, p. 114.

Leconte's type of *cruentus* is from Cape San Lucas, Lower California. Specimens examined from that region are mostly of a fulvous color and look quite different in series from those taken in Arizona, and it is possible that two or more species are involved. No genitalic or other characters of a definite nature could be found for splitting this apparent complex. The genitalia of *fernandezi* and *lecontei* are very similar in structure, and it therefore seems likely that any segregation of species based on genitalic characters must be determined by a study of large series that are not at this time available.

Lycus sanguineus Gorham (Fig. 4.)

1884. *Lycostomus sanguineus* Gorham, Biol. Cent. Amer., Coleop., III, pt. 2, p. 226.

Rufous or scarlet; elytra in apical fourth or fifth, antennae except basal joint, palpi, and tarsi black. Head, pronotum, and ventral surface clothed somewhat sparsely with short prostrate hairs; elytra nearly glabrous, pubescence evident at base and on scutellum, elsewhere the hairs are widely distant and inconspicuous; ventral vestiture unmodified in the male. Beak short and stout, its length nearly one and one-half times the distance between the eyes; antennal joints 4 to 11 each with one or more denticles on the inner side, third joint seven-tenths as long as 4 and 5 combined; palpi rather slender; elytra of female abbreviated and narrowed, with the unusually broad abdomen partly visible from above at the sides and apex; mesosternum protuberant except in front; metatibial spurs similar, acute. Length 11.5–14.5 mm.

ARIZONA: Globe, V–6 to 16; Pinal Mts., VI–4; Baboquivari Mts., IV–28, VI–8; Benson, V–12; Huachuca Mts., VI–9; Tucson, V–5; Prescott; Payson, VI–11; Catalina Mts., V–11; Chiricahua Mts., Pinery Canyon, 6000 ft., VI–5.

NEW MEXICO: Organ Mts., Dona Ana County, IV–23.

TEXAS: Alpine, IV–18.

Superficially resembling *lecontei, sanguineus* may be recognized by its subglabrous elytra with smaller apical black spot. It was described from northern Sonora. The short vestiture of the antennae is, in the male, erect along the inner side of joints 4 to 11, a character that has not been noted in any other species except *sanguinipennis*.

Lycus sanguinipennis Say (Fig. 5.)

1823. *Lycus sanguinipennis* Say, Jour. Acad. Nat. Sci. Phila., III, p. 178.

Black; elytra and explanate sides of pronotum rufous, elytra with a small irregular scutellar dark spot. Moderately densely clothed above and beneath with short prostrate hairs, pubescence of the sterna longer and inclined, not modified in the male. Beak short and stout, its length about equal to the distance between the eyes; third antennal joint three-fifths as long as 4 and 5 combined, pubescence of joints 4 to 11 erect but not longer along inner side in the male; palpi somewhat dilated, distinctly wider apically; mesosternum protuberant except in front; metatibial spurs similar, acute. Length 9–13.5 mm.

ARIZONA: Santa Catalina Mts., VI–30 to VII–21, Bear Wallow, 8000 ft., VI–13 to VII–17, Mt. Lemon Sta., VII–11; Graham Mt., VII–27; Huachuca Mts.; Pinal Mts., Gila County, VI–18, VIII; Crown King, VI–28; Sierra Ancha Mts., VII–5 to VIII–5; Lakeside, VI–11; White Mts., VII–25; Santa Rita Mts., VIII–14.

NEW MEXICO: Jemez Mts., VII–4 to VIII–9; Frijoles Canyon near Hot Springs, Las Vegas, 7000 ft., VII; Beulah, VI–29, VIII–17; Cloudcroft, VI–19.

COLORADO: Mineral County, VI–16; Palmer Lake, VI–30; Boulder, Jim Creek, 6400 ft., VII–8; Green Mt. Falls, VI–20; Manitou, 6400 ft., VII–5.

Leconte erected the genus *Rhyncheros* for this species because of its very short beak, none of the other species with similarly short beaks being known to him at the time. Apparently there is nothing to warrant the retention of *Rhyncheros* as a subdivision of *Lycus*.

Lycus fulvellus Leconte (Fig. 6.)

1881. *Lycostomus fulvellus* Leconte, Trans. Amer. Ent. Soc., IX, p 18.

Black; sides and apex of pronotum, elytra, and sides and apex of abdomen fulvous or flavate; scutellum black; black area of pronotum covering nearly all of the central convex surface. Dorsal surface, except head, subglabrous; ventral surface pubescent, prosternal crest and mesosternal protuberance clothed with suberect arcuate hairs, these longer and denser in the male. Beak short and stout, its length about one and one-half times the distance between the eyes; third antennal joint five-sixths as long as 4 and 5 combined; palpi somewhat dilated, distinctly wider apically; pronotum alutaceous, anterior angles prominent, apical lobe rounded; mesosternum protuberant except in front, protuberance strongly convex in the male, lower and flat in the female; metatibial spurs similar, acute. Length 13 mm.

COLORADO: Cascade, VII–9.

NEW MEXICO: Gallinas Creek, Sante Fe National Forest, 7500 ft., VI–16; Las Vegas.

ARIZONA: Alpine, White Mts., 8400 ft., VI–23.

Lycus fulvellus subspecies **femoratus** Schaeffer

1911. *Lycostomus femoratus* Schaeffer, Jour. N. Y. Ent. Soc., XIX, p. 120.

Agrees closely with *fulvellus*, differing in color by having the pronotal dark spot much reduced and usually confined to the median channel; trochanters and femora fulvous, the latter tipped with black; and the three basal antennal joints more or less pale beneath. Length 11–14 mm.

ARIZONA: Huachuca Mts.; Chiricahua Mts., 8600 ft., VII–16; Santa Rita Mts., VI–14, VIII–8; Sierra Ancha Mts., VIII–5; Pinal Mts., V, VI–15, VII–20; Miami, VI–27; Santa Catalina Mts, VI–30, VII–20, Bear Wallow, 8000 ft., VII–12, Mud Springs, 6500 ft., VII–17, Mt. Lemon, VI–30, VII–24; Fort Grant, VII–15; Patagonia, VII–6; Fort Apache, VI–16.

Schaeffer stated that *femoratus* differs from *fulvellus*, in addition to the above mentioned color characters, by having the hind tibiae less arcuate, the thorax wider and more distinctly trisinuate in front, and the alternate elytral costae distinctly more elevated than the others, especially in apical half. These differences are all variable and would apply only to selected specimens. The male genitalia of the two forms are identical and *femoratus* is therefore reduced to subspecific rank. Its habitat in the United States seems to be limited to southern Arizona.

Lycus rubescens Schaeffer (Fig. 7.)

1908. *Lycostomus rubescens* Schaeffer, Jour. N. Y. Ent. Soc., XVI, p. 63.

Fulvous or rufous; head, antennae, palpi, femora apically, tibiae and tarsi black. The head varies in color to fuscous with the beak paler, and the metasternum and abdomen may be slightly dusky medially. Head and pronotum distinctly pubescent; elytra subglabrous, the pubescence evident narrowly at base, more broadly at apex, and along the sides exterior to the humeral costa. Ventral surface pubescent, vestiture unmodified in the male. Beak short and stout, its length about one and one-fifth times the distance between the eyes; third antennal joint two-thirds as long as 4 and 5 combined; palpi somewhat dilated, wider apically; mesosternum distinctly protuberant, more strongly in the male, the summit feebly concave in both sexes; metatibial spurs similar, acute. Length 10–13 mm.

ARIZONA: Huachuca Mts.; Florence; Phoenix; Douglas, VII–1; Chiricahua Mts., 7000 ft., VI–24.

Lycus sagittatus new species (Fig. 8.)

Flavate; palpi more or less and last two joints of tarsi darker, antennae black except three basal joints, the fourth and fifth sometimes partly pale, tibiae entirely pale or darker apically. Dorsal surface moderately shining, virtually glabrous in the male with only the head very sparsely pubescent, distinctly but sparsely and irregularly pubescent throughout in the female; ventral surface sparsely pubescent in both sexes, vestiture of prosternal crest and mesosternal protuberance unmodified in the male. Length 7–10 mm.

MALE. Head nearly flat between the eyes, not impressed behind the antennal prominence; beak stout, elongate triangular, its length one and three-fourths times the distance between the eyes; maxillary palpi slender, not wider apically; third antennal joint slightly shorter than 4 and 5 combined, its upper surface finely reticulate and sparsely pubescent.

Pronotum about one-fourth wider than long; lateral margins nearly straight, converging from hind angles to the evident but not prominent anterior angles; surface smooth medially, anterior border and explanate sides obscurely punctate; median line not carinate apically, thence rather strongly channeled to base, the channel narrower posteriorly.

Elytra widest behind the middle where they are conjointly two-thirds wider than the pronotum and four-fifths longer than wide; costae not prominent, the intervals with rather coarse and dense irregular punctiform impressions, without distinct reticulating lines.

Prosternum compresso-carinate; mesosternum rather strongly protuberant, the summit concave; apical angles of abdominal sternites produced posteriorly, more strongly toward apex. Tibiae rather slender, arcuate; metatibial spurs similar, acute.

FEMALE. Differs from the male in being more slender, the elytra conjointly less than one-half wider than the pronotum and more than twice as long as wide. Pronotum very sparsely pubescent, the hairs fine and prostrate; elytra sparsely pubescent throughout, the hairs longer and nearly straight, rather coarse, denser and inclined on the costae and margins, sparse and suberect on the intervals; mesosternum less strongly protuberant, the summit broader and nearly flat; tibiae feebly arcuate.

Holotype.—Male; Chisos Mts., Texas, June 9, 1939, collected by D. J. and J. N. Knull; located in Ohio State University collection.

Allotype.—Female; same data and location as holotype.

Paratypes.—TEXAS: Chisos Mts., VI–9; El Paso, 15 mi. E., VI–22; "Tex." (Horn collection).

The paratypes (11) are distributed in the collections of Academy of Natural Sciences of Philadelphia, Ohio State University, California Academy of Sciences, and the author.

This species closely resembles a very small *simulans* or *loripes*. The beak is intermediate in length between the two extremes found in those species. It is unique thus far among the uniformly pallid *Lycus* occurring in our fauna because of the comparatively conspicuous elytral pubescence of the female.

Lycus minutus new species (Fig. 9.)

Flavate; antennae except basal joint, palpi, tibiae and tarsi black; second and third antennal joints beneath, and sometimes above also, pale or fuscous; scutellum pale, the mesonotum each side dark. Varies with the tibiae and tarsi partly pale, and the metathorax beneath dark each side. Dorsal surface, except head, shining and nearly glabrous, the elytra of female with sparse minute hairs on the costae; ventral surface pubescent, the vestiture longer, suberect, and apically curved on the prosternal crest and mesosternal protuberance of the male. Length 7-9 mm.

MALE. Head feebly concave between the eyes, not distinctly impressed behind antennal prominence; beak short and stout, its length less than one and one-half times the distance between the eyes; maxillary palpi rather slender, not distinctly wider apically; third antennal joint four-fifths as long as 4 and 5 combined, its upper surface finely reticulate and sparsely pubescent.

Pronotum one-fourth wider than long; lateral margins nearly straight and converging from base to the usually very prominent anterior angles; surface smooth and shining medially, anterior border and explanate sides irregularly and rather coarsely punctate; median line feebly carinate at apex, thence strongly channeled to base, the channel narrower posteriorly.

Elytra widest behind the middle where they are conjointly seven-tenths wider than the pronotum and three-fourths longer than wide; surface shining, costae distinct, reticulating lines poorly defined, forming an irregular double row of cells between the costae, the cells punctiform basally, sometimes throughout.

Prosternum compresso-carinate; mesosternum protuberant except in front, the summit nearly flat; apical angles of abdominal sternites produced posteriorly, more strongly toward apex. Tibiae rather slender, arcuate, the metatibiae less strongly; metatibial spurs similar, acute.

FEMALE. Differs from the male in being more slender, the elytra conjointly one-half wider than the pronotum and twice as long as wide; elytral costae with very sparse minute decumbent arcuate hairs; ventral pubescence unmodified; tibiae nearly straight.

Holotype.—Male; Sabina Basin, Santa Catalina Mts., Arizona, July 8 to 20, 1916; located in collection of American Museum of Natural History.

Allotype.—Female; Durango City, Mexico, collected by H. F. Wickham; located in collection of Academy of Natural Sciences of Philadelphia.

Paratypes.—ARIZONA: Same data as holotype; Texas Pass, VII-20; Pinal Mts., VII-22; Huachuca Mts., Ramsey Can., VII-10. MEXICO: Durango City.

The paratypes (19), all males, are distributed in the collections of Academy of Natural Sciences of Philadelphia, American Museum of Natural History, California Academy of Sciences, Cornell University, and the author.

This species is of the same size and appearance as *sagittatus,* and considerably smaller than the closely similar *loripes* and *simulans.* Because of its very short and stout beak, exactly as in *simulans, minutus* could not be mistaken for either *sagittatus* or *loripes.* In all the Arizona specimens of *minutus* that have been examined, only the first antennal joint is entirely pale, and this character alone is sufficient to separate it from our other flavate species. The antennal color character, however, does not hold satisfactorily for examples of *minutus* from Durango City, Mexico. Males of *simulans* may be distinguished from these by their much longer, denser, and more erect pubescence of the mesosternal protuberance; and the females by their more nearly glabrous elytra.

Lycus simulans Schaeffer (Fig. 10.)

1911. *Lycostomus simulans* Schaeffer, Jour. N. Y. Ent. Soc., XIX, p. 121.

Flavate; antennae except first three joints, palpi, and tarsi black; tibiae varying from entirely black to entirely pale, usually darker in the female. Varies with head posteriorly, scutellum, and ventral surface of metathorax black. Dorsal surface, except head, nearly glabrous; ventral surface pubescent. Beak short and stout, its length less than one and one-half times the distance between the eyes; third antennal joint four-fifths as long as 4 and 5 combined; palpi rather slender, slightly wider apically. Pronotum smooth and shining medially, the sparse pubescence somewhat denser and more conspicuous in the female. Male with mesosternum rather strongly protuberant, the summit flat; prosternal crest, mesosternal protuberance, and adjacent parts of metasternum densely clothed with rather long erect pubescence, the hairs straight with their tips curved. Female with mesosternum less protuberant, the sternal vestiture shorter, arcuate and inclined. All tibiae strongly arcuate in the male, feebly in the female; metatibial spurs similar, acute. Length 10–12 mm.

ARIZONA: Huachuca Mts., VII-18, Carr Canyon, VII-12, Montezuma Pass, VII-20, Miller and Ramsey Canyons; Pinal Mts., VII-3 and 24; Santa Catalina Mts., Mud Springs, 6500 ft., VII-12; Santa Rita Mts., Madero Canyon, VIII-16; Prescott, VII-23; Fort Grant, VII-13; Yuma, VI; Palmerlee, 7500 ft., VI-18.

TEXAS: Davis Mts., VI-28, VII-2; Sierra Blanca, VII-4; El Paso, VII-1.

Lycus loripes Chevrolat (Fig. 11.)

1835. *Lycostomus loripes* Chevrolat, Col. Mexique, fasc. 6, p. 148.

Color, vestiture, and sculpture as in male *simulans*, the pronotal pubescence not appreciably differing in the sexes. Structure as in *simulans* except as follows: beak long and slender, its length about two and one-fifth times the distance between the eyes; third antennal joint as long as 4 and 5 combined; palpi slender, not wider apically. Length 10–13 mm.

ARIZONA: Huachuca Mts., Carr and Miller Canyons, VII–10 to 18; Baboquivari Mts., Kits Peak, 4050 ft., VIII–1; Santa Catalina Mts., Sabino Basin and Mud Springs, VII–2 to 20; Chiricahua Mts., Pinery Canyon, 5200 ft., VII–15; Dragoon Mts., Texas Pass, VII–20; Fort Grant, VII–15; Coyote Mts., 3500 ft., VIII–4; Yuma County, VI; Nogales, VII–15; Bisbee, VII–12 to 17; San Carlos, VII–12; Wilcox, VIII–8; Gleason, VII–16; Palmerlee; Santa Rita Mts., VII–21.

TEXAS: Chisos Mts., VII–9.

Lyconotus new subgenus

Form and structure similar to *Lycostomus* except as follows: prosternum not longitudinally compressed, mesosternum not protuberant, inner angle of metacoxae not produced posteriorly; tibial spurs minute, acute and similar throughout; male with trochanters spinose, metafemora and metatibiae strongly arcuate, and aedeagus and sternite 9 both abruptly bent downward medially. Elytra, as in *Lycostomus*, not broadly dilated in the male.

TYPE. *Lycus lateralis* Melsheimer.

Lycus lateralis Melsheimer (Fig. 12.)

1846. *Lygistopterus lateralis* Melsheimer, Proc. Acad. Nat. Sci Phila., II, p. 302.

Black; humeri and sides and apex of pronotum fulvous; black area of pronotum occupying nearly all of median convex surface; fulvous humeral spot variable, usually broad at base, not reaching the suture, and narrowing posteriorly to about middle of elytra. Body clothed above and beneath with short decumbent pubescence, similar in the sexes. Beak slender, rather long, its length more than one and one-half times the distance between the eyes; third antennal joint only slightly longer than fourth, about three-fifths as long as 4 and 5 combined; palpi slender, slightly wider apically. Pronotum with apical lobe rounded, limited each side by a feeble sinuation, the anterior angles lacking; median channel obliterated. Prosternum not compresso-carinate; mesosternum not protuberant; apical angles of abdominal sternites acutely produced posteriorly only in 7 and 8 of male. Tibial spurs small, but little longer than the apical setae. Male with posterior femora and tibiae strongly arcuate, all trochanters spinose; sternite 9 with basal part broad, abruptly concave throughout its width, bottom of concavity flat, smooth and shining, glabrous; apical part of sternite 9 convex, narrowly triangular, sparsely pubescent, bent abruptly downward at right angles to basal part; aedeagus similarly bent to conform to sternite 9. Length 9-10 mm.

Distribution.—Ranges from Maine south to Florida and west to Illinois, Missouri, Kansas, and Texas. A male in the collection of the California Academy of Sciences was collected at Fort Clayton, Panama Canal Zone.

EXPLANATION OF FIGURES

The letters a, b, and c signify, respectively, dorsal, lateral, and ventral aspects.

Fig. 1.—*Lycus arizonensis* new species, male genitalia and maxillary palpus. Pinal Mts., Arizona, VII-20-47, F. H. Parker.

Fig. 2.—*Lycus fernandezi* Duges, male genitalia and maxillary palpus. Globe, Arizona, VIII-2-47, F. H. Parker.

Fig. 3.—*Lycus lecontei* new name, male genitalia. 20 mi. W. San Augustine, Lower California, IX-24-41, Ross and Bohart.

Fig. 4.—*Lycus sanguineus* Gorham, male genitalia. Globe, Arizona, V-8-48, F. H. Parker.

Fig. 5.—*Lycus sanguinipennis* Say, male genitalia. Catalina Mts., Arizona, VII-1936, E. S. Ross.

Fig. 6.—*Lycus fulvellus* Leconte, male genitalia Sante Fe National Forest, New Mexico, VI-16-47, C. P. Alexander.

Fig. 7.—*Lycus rubescens* Schaeffer, male genitalia. Cave Creek, Cochise County, Chiricahua Mts., Arizona, VI-24-27, J. A Kusche.

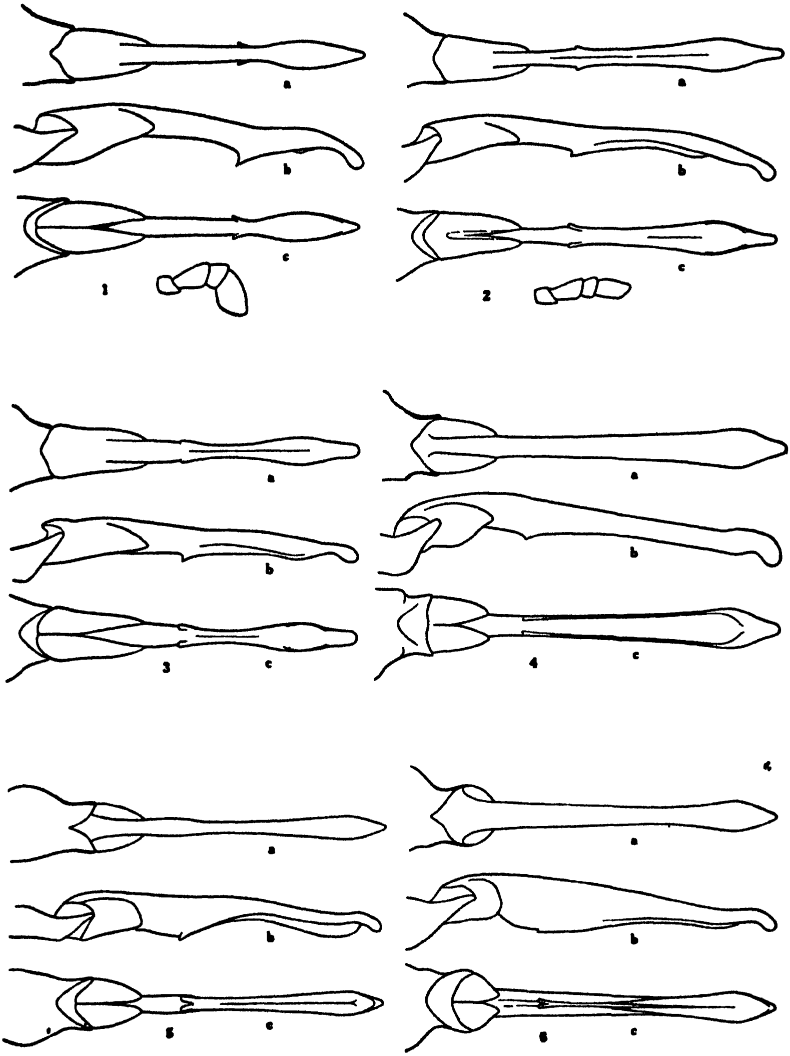
Fig. 8.—*Lycus sagittatus* new species, male genitalia. Chisos Mts., Texas, VI-9-39, D. J. and J. N. Knull.

Fig. 9.—*Lycus minutus* new species, male genitalia. Sabino Basin, Santa Catalina Mts, Arizona, VII-8 to 20-16.

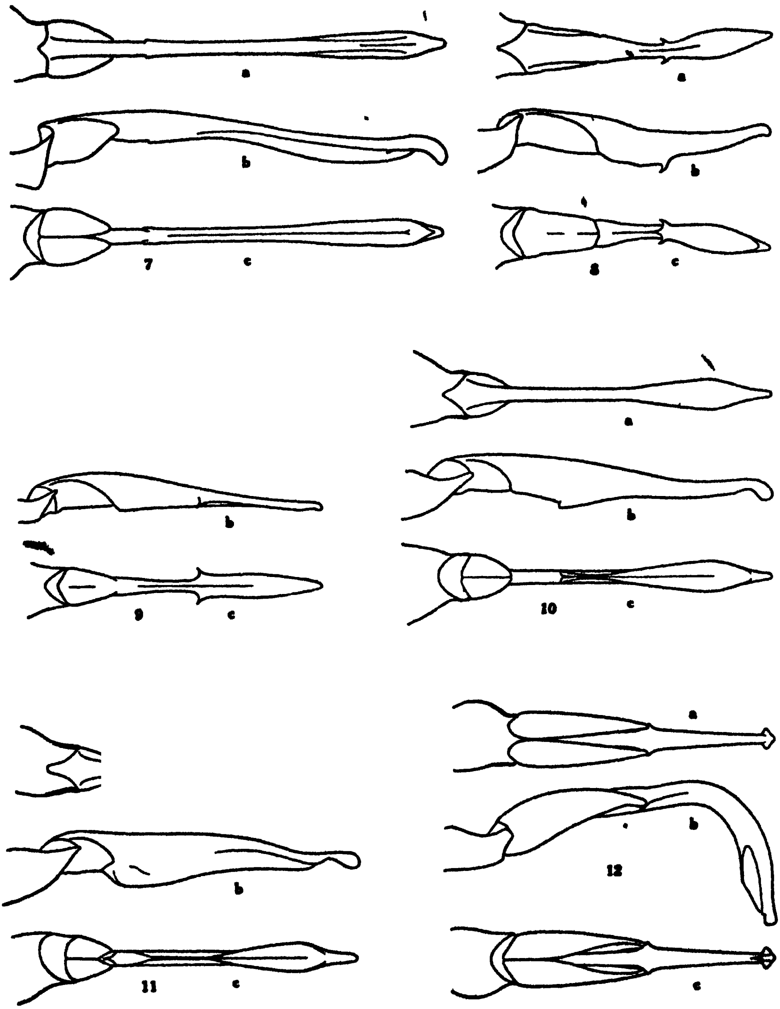
Fig. 10.—*Lycus simulans* Schaeffer, male genitalia. Pinal Mts., Arizona, VII-24-41, F. H. Parker.

Fig. 11.—*Lycus loripes* Chevrolat, male genitalia. Pinal Mts., Arizona, VII-10-48, F. H. Parker.

Fig. 12.—*Lycus lateralis* Melsheimer, male genitalia. Lake Placid, Florida, IV-24-47, J. G. Needham.



Figures 1–6



FIGURES 7–12

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HISTOLOGICAL AND MORPHOLOGICAL FACTORS IN THE PENETRATION OF DDT THROUGH THE PULVILLI OF SEVERAL INSECT SPECIES

BY D. S. SARKARIA [1] AND ROBERT L. PATTON [2]

(Plates VI and VII)

INTRODUCTION

The observation that insects can be killed by films of DDT when they are exposed by momentary contact with their feet has led to an evaluation of the factors involved in the penetration of this material through the pulvilli and tarsal segments of several species of insects of varying susceptibility. The investigation of the factors involved included both a study of the histological anatomy of the pulvilli and the tarsal segments, and studies of the position of these elements during the normal walking process. The species investigated include the house fly, *Musca domestica* (Linn.); the honey bee, *Apis mellifera* Linn.; the milkweed bug, *Oncopeltus fasciatus* (Dallas); and the German cockroach, *Blatella germanica* (Linn.). These are listed in an ascending order of resistance to DDT as it is applied through the pulvilli.

LITERATURE

Relatively few studies have appeared in the literature describing the pulvilli of the species investigated; however, histological studies of the tarsi and legs of other forms are common. Thus Dewitz (1884) [3] studied the histological structure of the flattened tarsi of the beetle, *Telophorus dispar* (Hbrst.); and the tarsi of a locust (Orthoptera). He states that the tenent hairs on the foot of the beetle end in sharp points, below which are openings of canals. The glands attached to the canals are unicellular and are situated in the hypodermis of the tarsus. The glands he describes as being invested by a structureless tunica propria, and containing granular protoplasm. A nucleus is to be found at the inner side and a vesicle prolonged into a tube, which traverses the neck of the gland, is attached to the root of the hair so that the vesicle receives the secretion. Each gland is invested with a fine nerve twig.

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[3] Dewitz, H. Ueber die Wirkung der Haftlappchen toter Fliegen. Ent. Nachr., 10: 286–287, 1884.

In 1923 Arnhart[4] reported on the histology of the foot of the honey bee. He describes the structure of a tarsal gland and the nature of the membranous pulvillus which is brought into contact with the surface to aid in adhesion. Snodgrass (1923)[5] corroborated Arnhart's observations. Snodgrass (1942)[6] states that observations have failed to reveal the presence of any sticky exudation from the spines of the planta that has been previously believed to help the arolium to adhere to the smooth surfaces.

Hayes and Liu (1947)[7] made a comparative study of the histology of the house fly, the German cockroach, and the adult and larval forms of the Mexican bean beetle. In the house fly these authors describe the presence of chemoreceptive and tactile sensillae on the tarsal segments, and they believe that the pulvillus is a hollow membranous structure with numerous internal channels. In the German cockroach chemoreceptive, tactile, and campaniform sensillae are absent. They describe the cockroach pulvillus as a bell-shaped membranous structure with numerous tenent hairs on the surface. The distal end of the pulvillus is invaginated and forms two folds at the tip. A layer of gland cells comprising the tenent gland is present at the distal margin and a layer of hypodermal cells runs along the lateral margins. Nerve cells are present in the cavity. The thickness of the cuticula was measured and found to be 12.5 to 25 microns in the house fly and 60 to 90 microns in the cockroach. This difference in thickness was interpreted as a factor in the apparently greater resistance of the cockroach.

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[4] Arnhart, L. Das Krallenglid der Honigbiene. Archiv für Bienenkunde, 5: 37–86, 1923.

[5] Snodgrass, R. E. The Anatomy and Physiology of the Honey Bee. McGraw-Hill Publishing Co., New York, 1923.

[6] Snodgrass, R. E. The Skelato-Muscular Mechanism of the Honey Bee. Smithsonian Miscellaneous Collection, 103: No. 2, 1942.

[7] Hayes, Wm. P., and Yu-Su Liu. Tarsal Chemoreceptors of the House Fly and Their Possible Relations to DDT Toxicity. Annals Ent. Soc. of Amer., 11: 401–416, 1947.

MATERIALS AND METHODS

The insects were selected according to their susceptibility to poisoning with DDT when applied by contact of the last tarsal segments with dry crystals. The methods used in the preparation of crystals, handling of insects and evaluating susceptibility will be discussed in another paper.

The tarsi to be used for the histological study were obtained from insects which had been killed by immersion in hot water and fixed with Bouin's or with Dietrich's fixative. Fixed tissues were imbedded in paraffin. Tarsi of *Blatella germanica* and *Oncopeltus fasciatus* were taken immediately after a moult before the hardening of the cuticle had taken place. A comparison of these tissues and those from hardened tarsi showed no difference in anatomical structure. Longitudinal, frontal, and transverse sections were cut at from 5 to 10 microns. These were mounted in the usual way, stained with Heidenhain's hematoxylin, and counterstained with eosin. In toto mounts were used for the study of the external structures.

HISTOLOGY OF THE HOUSE FLY PULVILLUS

The tarsi of the house fly are composed of five segments or tarsomeres, the terminal one bearing the "foot." This consists of a pair of claws (Plate VI, figure 1, CL), and a pair of large lateral lobes, the pulvilli (Plate VI, figure 1, P). The pulvilli arise from the auxiliary plates, one beneath the base of each claw, and are covered on the ventral surfaces with numerous closely set hairs. These are the tenent hairs (Plate VII, figure 1, TH). At the bases of the claws and the pulvilli are two small sclerites and planta and the unguitractoral plate. The surface of the tarsus is covered with hairs and spines.

Each pulvillus is a dorsoventrally flattened cuticular sac. Its dorsal cuticular wall is quite thick but the ventral wall consists of very thin cuticle with numerous hollow tenent hairs which open into the lumen of the pulvillus. The lumen in the pulvillus is broader at the proximal end but narrows down towards its distal margin. It opens into the haemocoel of the last tarsal segment. The lumen in the pulvillus is apparently occupied by a single giant cell. This cell has a large nucleus situated near the broader end

(Plate VII, figure 1, NC). A bundle of fibers which appear to be nerve fibers is present in the channel which connects the lumen of the tarsus with the pulvillus. This bundle of fibers seems to arise from a group of small cells in the tarsal cavity (Plate VII, figure 1, X). These cells have small deeply staining nuclei with big round nucleoli and have no definite cell outlines. The cytoplasm of this mass of cells is also deeply stained like their nuclei. These cells are probably sensory in nature but their function can not be determined by histological means.

The tarsal cavity is lined by epidermal cells arranged in a single layer. The nuclei of these cells are quite large and vesicular with very few chromatin granules. In between the epidermal cells are many rather deeply staining large cells. They have large deeply staining nuclei full of chromatin granules (Plate VII, figure 1, EPI). Since these cells are present at the bases of sensory hairs, it follows that they are sensory in nature. The sensory cells can be easily differentiated from the epidermal cells.

Histology of the Honey Bee Pulvillus

The last or fifth joint of each tarsus of the honey bee carries terminally a pair of large, moveable lateral claws, and a complicated median organ ending in a soft lobe turned upwards between the claws (Plate VI, figure 2, CL and AR). The terminal soft lobe is called the arolium. Dorsally the arolium has a deep concavity between the upturned lateral parts, and in its outer wall there is a dark, elastic, U-shaped band, the arcus (Plate VI, figure 2, ARC), which embraces the base of the arolium ventrally with its arms extending distally in the lateral walls. The conical base of the median organ or pretarsus contains dorsally an elongated median sclerite armed with five or six long thick curved spines. This sclerite is articulated to the end of the tarsus between the claws by its widened base, and the narrowed distal end is attached to the scoop-shaped arolium like a handle. In the ventral wall of the pretarsal base is a broad weakly sclerotized plate, the planta (Plate VII, figure 3, PLN), which is thickly beset with strong spines diverging distally.

The concave dorsal surfaces of the aroliar lobes are covered with short hairs but their lateral and ventral surfaces are smooth and rounded. In longitudinal section the arolium appears to be a conical structure with its broader side at the proximal end. Ventrally it is slightly convex and the cuticle is very thin, while on the dorsal side the cuticle becomes much thicker towards the proximal end. There is a small cavity in the arolium, into which a cord of cells extends from the tarsal segment. This cavity divides the arolium into a lower thicker pad-like structure and an upper portion similar in structure but much thinner. This pad-like structure consists of deeply staining fibers which arise from the distal end of the arcus on the ventral side. These fibers run longitudinally and branch dichotomously. In between the fibers small deeply staining round dots are seen which appear to be the cut ends of these fibers. Due to the position of these fibers they appear to be elastic in nature, and, as believed by Snodgrass (1942 loc. cit.), help in expanding the aroliar pad when it is in use.

The nature of the cord of cells (Plate VII, figure 3, X) could not be determined from a study of the histological sections; however, it is clear that they arise in the tarsal segment.

HISTOLOGY OF THE MILKWEED BUG PULVILLUS

The tarsus of the milkweed bug consists of three segments and the surface of each segment is covered with numerous spines and hairs. The foot consists of the pretarsus situated at the distal end of the third tarsal segment. The pretarsus is composed of an unguitractor plate (Plate VI, figure 3A), a pair of large curved claws and a pair of stalked pulvilli. The stalks of the pulvilli arise from the distal margin of the unguitractor plate, ventral to the claws. Near the inner margin of the base of each stalk of the pulvillus, there is a spine with a long hair. This structure is probably the empodium (Plate VI, figure 3A).

The pulvillus consists of an oval pad-like structure attached to the distal end of the stalk (Plate VI, figure 3A, P). The stalk is composed of two segments. The ventral surface of the pulvillus is slightly convex and is covered with very small uniformly distributed tenent hairs. The dorsal surface is made up of narrow cuticular plates (Plate VI, figure 3B, PL) which are crescent shaped in cross section, the concavity being towards the inside of the pulvillus. These plates of cuticle are connected with each other by very thin cuticular membrane. From the inner side of these plates arise club-shaped structures which hang vertically downwards. These structures have elongated nuclei and deeply staining fibers which branch quite often and extend the whole length. On the inside of the ventral surface of the pulvillus there is a thick layer of tissue which is traversed by numerous vertical lines or canals. At the inner margin of this tissue layer there are a large number of deeply staining granules which are nearly round. These granules are mostly aggregated in one line and only a very few were observed to be scattered. Both segments of the stalk, at the end of which the pulvillus is situated, appear to be devoid of any cellular structures, except the blood cells. The epidermis is absent at this point. The lumen of the stalk is continuous with that of the pretarsus and the tarsal segment. The epidermis is also absent from the pretarsus. These structures are depicted in Plate VII, figures 4 and 4A.

The epidermal layer of the tarsus is composed of a single layer of cells, with small, round, vesicular nuclei. Each nucleus contains a rounded nucleolus almost in the center. The epidermis does not extend into the pretarsus but stops at the distal end of the tarsus. There is a mass of cells in the tarsal cavity near its opening into the pretarsus. These cells have oval deeply staining nuclei with one big nucleolus usually situated near the nuclear wall (Plate VII, figure 4A, NC). The nature of this tissue could not be determined, but the cells resemble those described by Deegener[8] in the insect *Hepialus hecta* L. These were described as glandular and responsible for the production of the mating scent in this species.

The claws consist of a thick cuticular covering with the inner core consisting of a bundle of closely packed extremely elongated spindle-shaped cells.

HISTOLOGY OF THE GERMAN COCKROACH TARSUS AND PULVILLUS

The tarsi of the German cockroach are each composed of five segments, the first four of which have pad-like swellings near their distal ends on the ventral sides. The surface of the tarsal segments is covered with many spines and hairs. Each foot is made

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[8] Deegener, P. The Androconia of *Hepialus hecta* L. Schroeder's Handbuch der Entomologie, 28–29, 1902.

up of the pretarsus at the distal end of the last tarsal segment, which consists of an unguitractor plate, a pulvillus or arolium, and a pair of large claws (Plate VI, figure 4).

The arolium arises from the distal end of the unguitractor plate. It is a lobe-like structure, broader and slightly bent downward at the distal end (Plate VI, figure 4, AR). The dorsal and ventral surfaces are covered with very small and uniformly distributed spines. A set of five large hairs is present near the distal margin on the dorsal surface. On the ventral side there is a slightly raised whitish area which is oval in outline. This has been called the aroliar pad by Snodgrass (1935).[9] Its surface is devoid of any spines and appears to be rough and crepe-like in nature.

The cuticle of the arolium is quite thin and uniform on the dorsal and ventral sides. The epicuticle and the endocuticle do not extend completely around the distal end of the arolium but stop on the edges of the aroliar pad (Plate VII, figure 5A). Thus the aroliar pad appears to consist entirely of the endocuticle and in longitudinal section it seems to extend across the whole of the distal end of the foot. In the pad are seen fine lines which may be fine canals, running from near the outer edge of the epidermis to the outer margin of the pad.

The epidermal layer in the arolium and the tarsal segments consists of a single layer of cubical cells; but at the ventro-distal end of the arolium the epidermis is not single layered. At this place the epidermis forms a mass of cells which appear to show no striking difference in structure from that of the other epidermal cells. The lumen of the arolium appears to be devoid of any muscles, trachea, or nerve fibers.

The cuticle of each tarsal segment, which consists of epicuticle, exocuticle, and endocuticle, is uniform in thickness except in the pad-like structures of each segment. In these pad-like structures the epicuticle and exocuticle are of the same thickness as at other places, but the endocuticle forms a very thick layer. The epidermal cells at these places are also different. Here the epidermal cells are much larger and their nuclei are elongated dorsoventrally. They are comparatively larger in size. In between these modified cells are also present groups of sensory cells which are connected with the sunken tactile spines. These tactile spines are arranged in two rows, running longitudinally on the pad-like structures (Plate VII, figures 6 and 6A, TS).

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[9] Snodgrass, R. E. Principles of Insect Morphology. McGraw-Hill Publishing Co., New York, 1935.

A nerve fiber, tracheal trunk, and an unguitractor tendon are present in all the tarsal segments.

Discussion

When the morphological and histological structures of the pulvilli and tarsi of the above insects are compared, marked variations are observed.

The tenent hairs are absent in the case of the honey bee and the German cockroach pulvilli. In the house fly the tenent hairs are quite long and hollow, with a small opening to the outside near their tips, while the tenent hairs in the milkweed bug are very small and spine-like.

The cuticle on the ventral side of the pulvilli of the honey bee, the house fly, and the milkweed bug is very thin as compared to that of the dorsal surface and other parts of the tarsi. The cuticle forms a large endocuticular pad at the ventrodistal end of the pulvillus in the German cockroach and the endocuticle is also very thick at the pad-like structures at the ventrodistal ends of each tarsal segment. The epidermis seems to be entirely absent in the case of the house fly, the honey bee, and the milkweed bug. The house fly pulvillus apparently contains only one big cell with no trace of epidermal cells lining the inner side of the cuticular wall. Based upon its position and the fact that a secretion apparently does exude from the pulvillus, the big cell found in this structure appears to be glandular in function.

In the milkweed bug there are also no traces of epidermal cells in the pretarsus and the stalks of the pulvilli. Even in the pulvillus no epidermal cells have been observed but it is possible that the club-like structures described previously may be modified epidermal cells. The absence of epidermis in these three insects is a very distinct difference from the structure found in the German cockroach. In the latter, the epidermal cellular layer is present in the pulvillus. At the ventrodistal end of the pulvillus the epidermis forms a mass of cells which Hayes and Liu (1947 loc. cit.) term the tenent gland. The epidermal cells in the pad-like structures at the ventro-distal ends of the tarsal segments may also be modified into gland cells. These modified epidermal cells in the German cockroach seem to be like the ones described by Dewitz (1884 loc. cit.) in the locust.

The epidermal sensory cells are only present in great abundance on the last or the fifth tarsal segment of the house fly while the tarsi of the other three insects have no such cells or sensory hairs connected to them except for a few sunken sensory hairs with sensory cells on the pad-like structures at the ventrodistal ends of the tarsal segments of the cockroach. From their position and structure the latter are probably tactile sensory hairs. The sensory hairs and cells of the fly tarsi have been described by Hayes and Liu (1947 loc. cit.) as chemoreceptive and tactile sensillae.

The internal canals described by Hayes and Liu (1947 loc. cit.) in the house fly pulvillus could not be found in the sections studied. In a tangential longitudinal section passing through the side of the pulvillus, the cuticle on the dorsal surface near the base shows corrugations which appear like canals in the sections (Plate VII, figure 2, CR). These may be identical to the structures described by these authors.

Following the suggestion made by Hayes and Liu (1947 loc. cit.) that the differential rate of susceptbility of insects to DDT may be correlated with the thickness of the cuticle, and with the other factors which have been mentioned above in mind, a classification has been attempted in an effort to relate structural similarities with the observed toxicity relationship. The insects are classified as follows:

1. Insects with a thin cuticular wall on the under surface of the pulvilli. This group includes the house fly, the honey bee and the milkweed bug.
2. Insects having sensory cells on the tarsal segments. This group includes the house fly, and the German cockroach.
3. Insects with tenent hairs on the pulvilli. This group includes the house fly and the milkweed bug.
4. Insects with the normal complement of cuticular layers. All layers are present in the insects studied except in the German cockroach which shows no exocuticle and no epicuticle on the ventral side, but does have a thick endocuticle.
5. Insects in which the epidermal layer is absent in the pulvillus. This group includes the house fly, the honey bee, and the milkweed bug.

Experimental data arrange the susceptibility of the test insects to dry DDT films in the following manner:

Very susceptible	House fly
Intermediate susceptibility	Honey bee
Moderately resistant	Milkweed bug
Resistant	German cockroach

From the data presented, there appears to be no histological feature which can be associated with the demonstrated susceptibility gradient. Sensory structures exist on the pulvilli of the house fly, the milkweed bug, and on the tarsal segments of the cockroach but the susceptibility data does not indicate that penetration of DDT is enhanced by these. The cockroach has a thick endocuticular layer on the ventral surface of the arolium, but the protein-chitin composition of this layer usually does not offer significant resistance to penetration. All the other insects have an epicuticular layer, and it has been demonstrated many times that this layer functions as a protective barrier.

A point of possible importance appeared during the progress of the investigation relating to the position of the pulvillus during the act of walking. It has been observed that the pulvillus of the house fly is in contact with the surface at all times while those of the milkweed bug and the honey bee are only in contact with the surface when their adhesive properties are needed. The normal position of the pulvillus during the act of walking may be a very important factor in the susceptibility of these insects to dry films of DDT. The presence of the long tenent hairs on the house fly pulvillus may also be a factor since DDT crystals may be trapped and held in contact with the foot. This would expose the crystals to the solvent action of the pulvillar secretions which might enhance its penetration. There is apparently no difference in the walking position of the pulvillus of normal and resistant strains of flies.

From the facts observed, it seems apparent that the presence of the long tenent hairs and the walking position of the pulvillus of the house fly are the only morphological features which could enhance its susceptibility to poisoning with dry DDT films. A point of interest which remains for further investigation is the determination of the chemical nature and the solvent action of the pulvillar secretions of these insects for dry DDT. It is apparent that under such circumstances, the DDT must be assimilated in a liquid state, and some evidence exists that the pulvillar secretion of the house fly is, in fact, an effective DDT solvent.

SUMMARY

The house fly, the milkweed bug, the honey bee, and the German cockroach were compared for their susceptibility to poisoning with dry crystals of DDT applied through contact with the pulvillus. Histological studies of the pulvillar structures and the last tarsal segments showed no striking weakness in the house fly except for the long hollow tenent hairs which were absent or reduced on the other forms, and the fact that the tarsus contained a large glandular structure. It was also observed that the normal walking position of the fly brought the pulvillus into contact with the surface at all times, while in the other insects studied, contact was made only when the adhesive properties of the pulvillar organ were required.

EXPLANATION OF PLATES

PLATE VI

Terminal segments of tarsi

Key to Plate VI.—AR, arolium; ARC, arcus; CL, claw; E, empodium; K, unguifer process; MN, manubrium; P, pulvillus; PL, cuticular plates; T_3, third tarsal segment; T_5, fifth tarsal segment; UP, unguitractor plate.

Fig. 1.—House fly, *Musca domestica.*
Fig. 2.—Honey bee, *Apis mellifera.*
Fig. 3.—Milkweed bug, *Oncopeltus fasciatus.*
Fig. 4.—German cockroach, *Blatella germanica.*

PLATE VII

Histological details of tarsi

Key to Plate VII.—AR, arolium; ARC, arcus; C, connection of sense cell with cuticula; CL, claw; CR, corrugations; CU, cuticle; DSC, distal process of sense cell; E, empodium; EN, endocuticle; EPI, epidermis; EXP, exo- and epicuticle; FH, fixed hairs; FI, fibers; HE, haemocoel; L, auxilia; M, aroliar pad; NC, nucleus; NSC, nucleus of epidermal sensory cell; NV, nerve; P, pulvillus; PL, cuticular plates; PLN, planta; S, spines; SC, sensory cells; T, tarsus; T_4, fourth tarsal segment; T_5, fifth tarsal segment; TH, tenent hair; TS, tactile spine; UP, unguitractor plate; X, cord of cells; Y, vertical lines or canals; Z, deeply staining round granules.

Figs. 1 and 2.—House fly, *Musca domestica.*
Fig. 3.—Honey bee, *Apis mellifera.*
Figs. 4 and 4A.—Milkweed bug, *Oncopeltus fasciatus.*
Figs. 5, 5A, 6 and 6A.—German cockroach, *Blatella germanica.*

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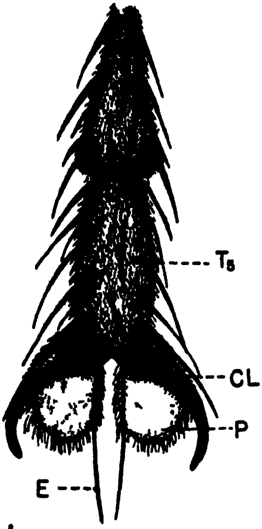

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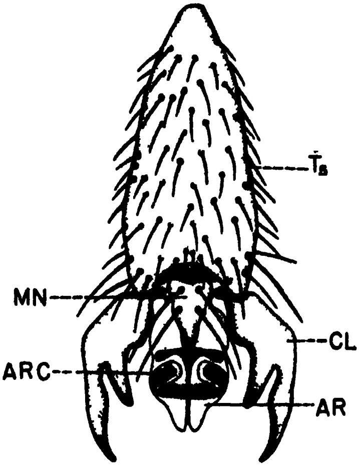

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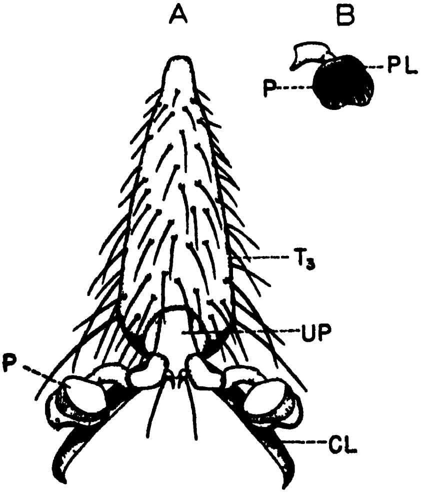

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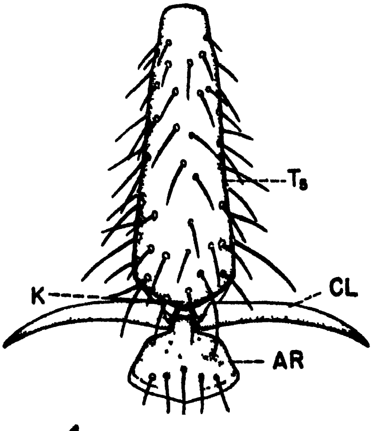

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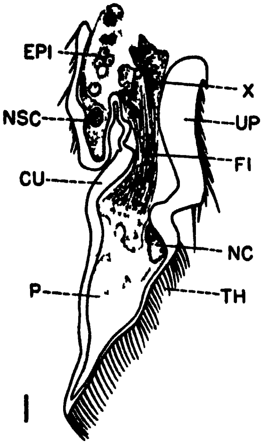
SARKARIA AND PATTON—HISTOLOGY AND MORPHOLOGY



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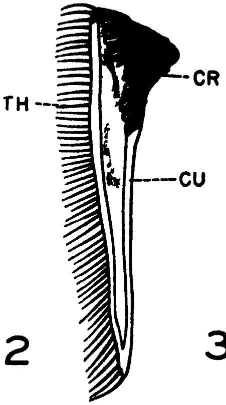

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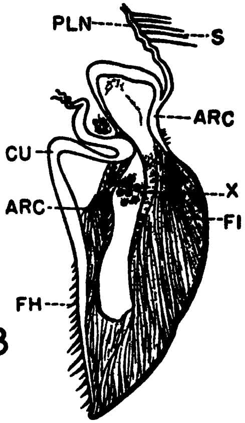

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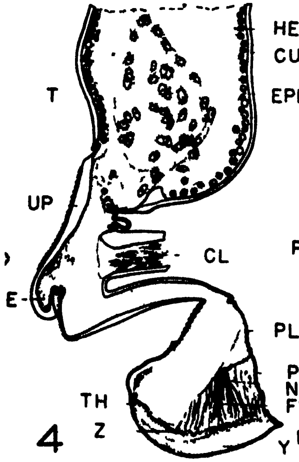

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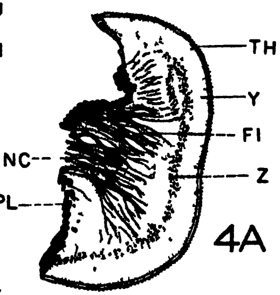

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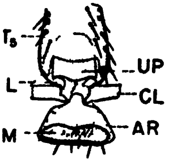

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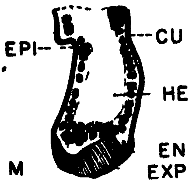

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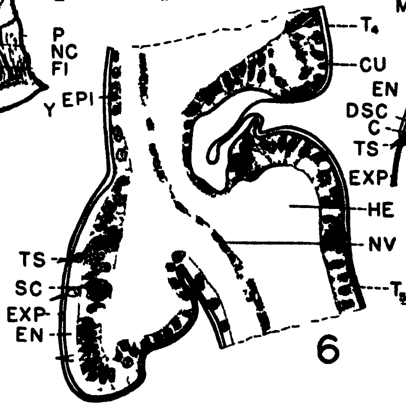

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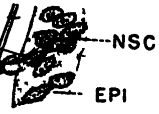

6A

SARKARIA AND PATTON—HISTOLOGY AND MORPHOLOGY

REVISION OF THE ANT TRIBE DACETINI: IV.

SOME GENERA PROPERLY EXCLUDED FROM THE DACETINI, WITH THE ESTABLISHMENT OF THE BASICEROTINI NEW TRIBE

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In his treatment of the tribe Dacetini in Fascicle 174 of the Genera Insectorum (1922), Emery included a number of genera in the group which were even at that time considered doubtfully placed. In the same year, Wheeler removed *Stegomyrmex* Emery to a new tribe Stegomyrmicini Wheeler (1922, p. 668) * and placed *Blepharidatta* Wheeler in the Attini (Wheeler, *loc. cit.*). I am not prepared to discuss Wheeler's treatment of these genera except as to their exclusion from the Dacetini, an action with which I am in complete agreement. *Stegomyrmex* is a very old genus, as shown by the wing venation; it is probably related to the Attini and perhaps to *Basiceros* Fred. Smith. The possible relationship to *Basiceros* does not, as I shall show in a later paragraph, ally *Stegomyrmex* to the true Dacetini.

Although the placement of *Blepharidatta* in the Attini is perhaps doubtful, an examination of the types of Wheeler's *B. braziliensis* shows that this placement is much more logical than attachment to the dacetines.

Later authors have added genera to the Dacetini which clearly do not belong there. Two of these, *Peronomyrmex* Viehmeyer and *Weberidris* Donisthorpe, are hereby placed in the tribe Meranoplini Emery.

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* Bull. Amer. Mus. Nat. Hist., XLV, pp. 655, 668.

PERONOMYRMEX Viehmeyer

Peronomyrmex Viehmeyer, 1922, Arch. Naturg., LXXXVIII, A 7, p. 212.
Peronomyrmex Brown, 1948, Trans. Amer. Ent. Soc., LXXIV, pp. 102, 125.

GENOTYPE: *Peronomyrmex overbecki* Viehmeyer (Monobasic).

In Viehmeyer's very scanty description and poor figures are brought out certain features which seem to place this genus in the Meranoplini. *Peronomyrmex* may be a synonym of *Meranoplus* itself. Viehmeyer gives the type locality as Trial Bay, New South Wales, but Mr. John Clark, the Australian myrmecologist, has mentioned (*in litt.*) certain indications that the localities of Viehmeyer's types from the Overbeck collections are often in error. It is quite certain that *Peronomyrmex* is not a dacetine ant.

WEBERIDRIS Donisthorpe

Weberidris Donisthorpe, 1948, Ent. Mon. Mag., LXXXIV, p. 281, fig. 1.

GENOTYPE: *Weberidris rufobrunnea* Donisthorpe (Monobasic). Synonym of *Calyptomyrmex* Emery, 1887, Ann. Mus. Stor. Nat. Genova, XXV, p. 471, GENOTYPE: *Calyptomyrmex beccarii* Emery (Monobasic).

Although Donisthorpe's species does bear a faint resemblance to certain dacetines in pilosity characteristics, it is certainly hard to understand how that author explained the several very great structural differences of the head, mandibles, etc. From the figure of *W. rufobrunnea,* it is evident that this ant belongs to *Calyptomyrmex,* of which numerous good figures appear in the literature. Mr. Donisthorpe now agrees to this synonymy.

With the exclusion of the genera mentioned above, the Dacetini form a more compact group. My extended study has revealed, however, that there are still remaining a number of genera which must be removed from the tribe. I refer to *Basiceros* Fred. Smith, *Rhopalothrix* Mayr and several closely related genera. These curious genera have been considered as dacetines by all the principal myrmecologists since the time of Mayr and Frederick Smith, and I myself placed them among the true dacetines in my preliminary generic revision of 1948.[1] I think this placement can be explained by the fancied similarity in habitus, and particularly in the usually bizarre pilosity displayed by the two groups. Once placed in the Dacetini during the formative years of ant taxonomy, no really close critical study has been made of the relationships of *Basiceros* to other dacetine genera. During later years, newly described genera were recognized as related to either *Basiceros* or to genera like *Daceton, Orectognathus* and *Strumigenys,* and since these four genera were all firmly entrenched in the Dacetini[2] by that time, the new genera were added as well. Forel and Emery closed arguments concerning affinities within the group by proposing classifications in which the dorsal position of the eyes, as opposed to a situation of these organs ventral to the antennal scrobe or within the scrobe, was accorded primary importance. This had the effect of relating genera like *Basiceros* and *Rhopalothrix* to *Daceton, Epopostruma, Orectognathus,* etc., and placing the "higher genera" like *Strumigenys* at some distance phylogenetically.

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[1] Trans. Amer. Ent. Soc., LXXIV, p. 102, 1948.

The genera with dorsolaterally placed eyes are assumed, in this arrangement, to have had a monophyletic origin. If one groups these "lower genera" according to obvious relationships among themselves, however, it is clear at once that they fall into two distinctly separable categories on the basis of body form (especially of the head and mandibles), sculpture, pilosity, etc., etc. One of these groups of genera attaches to *Basiceros,* the other to *Daceton.* Both groups contain genera showing reduction of numbers of segments in the antennal funiculus. The largest and therefore most primitive number occurs in *Basiceros* (and the related genus *Creightonidris* new genus, described below), which possesses 11 funicular segments. *Daceton, Acanthognathus, Orectognathus, Hypopomyrmex* and related genera have 10 or fewer funicular segments, but these are presently conceived as having no close phylogenetic relationship whatever to *Basiceros* or genera close to the latter. The higher genera contain forms (with a total of six or less antennal segments) which bear some superficial similarity to the basicerotine group in the shape of the mandibles, but, as I will demonstrate fully in a discussion of dacetine phylogeny now being prepared, this similarity is entirely a convergent one. An extensive survey of the entire tribe has forced me to the flat conclusion that all genera with a total of six or less antennal joints are descended from an ancestor related to *Daceton* and *Acanthognathus*, but not at all related to any basicerotine genus.

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[2] Various names have been used for this tribe, among which are Dacetonini, Dacetonii, Dacetii, etc. Since the tribal names should be formed from the root (in this case *dacet-*), with *-ini* added as the tribal suffix, the proper name for the group is *Dacetini,* and the author is Emery.

Since the tribe as it has been constituted obviously contains two distinct and not closely related stocks, and since *Daceton* Perty is the nominate genus of one tribal stock, I hereby propose a new tribe to receive *Basiceros* and related genera.

BASICEROTINI new tribe

Very small to medium-sized myrmicine ants, usually of bizarre appearance, the head narrowed in front and often furnished with deep lateral antennal scrobes. Eyes present or (rarely) absent, when present situated on the dorsolateral margins of the head. Antennae consisting of a basal scape and 11, 7 or 6 funicular segments. Mandibles, except in the aberrant genera *Heptastruma, Acanthidris* and *Talaridris,* triangular and furnished with serially dentate apical (masticatory) margins.

Propodeum usually armed with a pair of teeth or lamelliform structures. Petiole and postpetiole diverse in shape, the former armed anteroventrally with one or more irregular spines or teeth, but neither node with lateral or dorsal spongiform or lamelliform tissue or dentiform processes.

Integument thick and hard, the entire, or nearly the entire, body surface usually thickly sculptured and opaque. Hairs bizarre, often of two or more forms on a single individual, squamate, clavate, laciniate or pompon-like, but not closely resembling those of the Dacetini in basic details.

Color testaceous or ferruginous to brownish-black.

The members of the tribe as presently restricted are found in the Neotropical and Papuan regions and somewhat peripherally in the Indomalayan region. All seven of the presently recognized genera occur in the Neotropical region, while only one, *Rhopalothrix*, is found in the Old World. It is evident that the tribe is a very old one which once must have inhabited a large part of the earth's surface, but which is now being forced to contract its range into the same areas into which other old genera of ants (*Acanthoponera,* etc.) have similarly retreated.

Practically nothing is known of the basicerotine ethology. The species form rarely seen nests in the soil cover or beneath, in rotten logs, and in similar situations usually sought out by small arthropods with comparable cryptobiotic habits. Although the food is not known, it is presumed from the convergent characters shared by many of the species with certain dacetine ants, that it must consist largely or entirely of small arthropods frequenting the same cryptobiome. It is entirely possible that competition offered by more recently developed true dacetine stocks like *Smithistruma* and *Serrastruma* has been a major factor contributing to the present restriction of the tribal range.

Presented below is a systematic list of the basicerotine genera, with a citation of the original references and some of the more important later ones. It is probable that revisionary work on this group will produce more than a few changes; it also seems probable that many species yet remain to be described.

BASICEROS Schulz

Basiceros Schulz, 1906, Spolia Hymen., p. 156.

Ceratobasis Fred. Smith, 1860, Journ. Ent., I, p. 78, preoccupied name, worker *nec* female.

Meranoplus Fred. Smith, *sensu* Fred. Smith, 1858, Cat. Hymen. Brit. Mus. VI, p. 195, part. (Not Fred Smith, 1853.)

GENOTYPE: *Meranoplus singularis* Fred. Smith (Monobasic). The worker as described in Smith's 1858 work should be regarded as the type of the species *singularis* and hence of *Basiceros* as a genus; the female described in 1860 belongs to the genus *Creightonidris* described as new below, and the female described in the 1858 paper is too poorly characterized and figured to allow placement in either genus with any certainty.

This genus may be seperated from the related *Creightonidris* new genus (see below) by the form of the mandibles, the subtriangular blades of which are evenly convex above, the apices gently deflected and not suddenly bent downward. There is no transverse crease in the dorsal surface near the bases of the blades, and the basal borders form curves away from the anterior clypeal border so as to enclose a semicircular or subtriangular interspace or "zwischenraum" of respectable dimensions. The apical borders are relatively straight, set with serially-arranged teeth or large denticles, opposite members meeting along the apical or masticatory margins when closure is complete. In his description of *B. squamifer* (*loc. cit. infra*), Borgmeier mentions no differences between the mandibles of his females and workers taken from the same nest, so I assume that both neuter and female castes of *Basiceros* have the same type of mandibles.

The genus occurs in tropical America from at least as far north as Costa Rica south into southern Brazil. Donisthorpe's record of a *Basiceros* male from Dutch New Guinea (Ann. Mag. Nat. Hist., 1948, ser. 12, vol. I, p. 131) is probably based on an erroneous determination.

Basiceros singularis (Fred. Smith)

Meranoplus singularis Fred. Smith, 1858, Cat. Hymen. Brit. Mus., VI, p. 195, pl. 13, figs. 6–10, worker, female.

Ceratobasis singularis Fred. Smith, 1860, Journ. Ent., I, pp. 78–79, worker *nec* female.

Basiceros singularis Wheeler, 1916, Bull. Amer. Mus. Nat. Hist., XXXV, p. 9, female.

Smith's original figure, especially that of the mandible (fig. 10), leaves little doubt that the worker of *Basiceros singularis* is closely related to the workers of *Basiceros* described by later authors. There is some doubt, however, about the original female described with the worker in 1858, since the figure of this is small and rather vague as to mandibular detail. When, in 1860, Smith set forth *Ceratobasis,* he did so partly on the basis of another female herein identified as belonging to *Creightonidris.* He does not compare the 1858 and 1860 females, but the two figures accompanying the descriptions of these do not agree very well. In 1860, Smith seems to have forgotten the existence of the female described two years earlier, and one wonders whether he had misplaced the type. Smith's type locality, "Ega, Brazil" (probably collected by Bates) may refer to the second female, or to the workers described earlier, or to all the specimens concerned; Smith was so notoriously lax in giving correct type localities that the simple designation "Amazonas" should probably be followed until the types in the British Museum are properly checked by a competent worker. It is my opinion that the female Wheeler mentioned (1916, *loc. cit.*) is the true *Basiceros* female; its mandibles are of the normal *Basiceros* conformation, and the general features of this specimen agree pretty well with Smith's descriptions and figures of the *singularis* worker. I would be inclined to place true *Basiceros* of this species in the Amazon-Orinoco fauna, and it seems that *singularis* is the common, if not the only, species inhabiting this area. A closely related new species is represented in my working collection by series from Costa Rica, Honduras, etc., in Central America; I cannot describe this form now. *Basiceros* contains also the species *convexiceps* Mayr, *disciger* Mayr and *squamifer* Borgmeier (1937).[2a]

CREIGHTONIDRIS new genus

Ceratobasis Fred. Smith, 1860, Journ. Ent., I, p. 78, female *nec* worker.
Ceratobasis of authors, part.
Basiceros Schulz and authors, part.

FEMALE.—Resembling the same sex of *Basiceros,* with 12 antennal segments and a deep antennal scrobe running the full length of the side of the head, but differing radically in mandibular form. Mandibles with swollen, dorsally convex basal portions occupying nearly half of the length; the apical portions slightly longer, with strongly convergent external borders and a very nearly straight pair of inner borders, bent sharply ventrad at nearly a right angle to the principal plane of the basal portions and having the two opposing blades which make them up sloping gently inward dorsally toward the inner (masticatory) borders. The straight apical portions of each mandible bear a row of nine or ten serially arranged triangular teeth or denticles which begin at the bend and increase gradually in size to the apex, the two series of teeth meeting on the midline in the closed mandibles. The swollen basal portions also meet on the midline, and the basal borders are transverse and contiguous to the anterior clypeal border at full closure, so that no appreciable opening is left anterior to the clypeus. These basal portions are almost divided into anterior and posterior portions by a deep transverse-oblique cleft running from the inner margins at least halfway across each mandible and ending shallowly there, the two opposite clefts meeting at the juncture of the two inner borders to form a broad V with its obtuse apex directed basally. From beneath, the ventral portion of the basal half of each mandible is seen to form a deeply hollowed shell; the position of the cleft on the dorsum is visible as a distinct translucent line. Viewed from the side, the basal swollen portions are quite conspicuous, and the apical portions are seen to be gently tapered to a rather acute point. This specialization is very different from any mandibular type the author has ever witnessed among the immense range of bizarre forms to be found in the entire family Formicidae

GENOTYPE: *Creightonidris scambognatha* new species, described below.

Creightonidris scambognatha new species

?*Ceratobasis singularis* Fred. Smith, 1860, Journ. Ent., I, pp. 78–79, pl. 4, figs. 12, 13, female (part) *nec* worker.
?*Basiceros singularis* of authors, part.

FEMALE, HOLOTYPE.—Total length, including mandibles, 7.4 mm.; head length, maximum measurable, excluding mandibles, 1.42 mm.; mandibles, viewed in the same plane which gives the maximum length measurement for the head proper, 0.42 mm. anterior extension; Weber's length of thorax, 1.84 mm.; greatest width of head (across occipital lobes just behind eyes) 1.25 mm. Posterior excision very shallow and broad; sides of head fairly straight and converging only moderately anteriorly; clypeus convex dorsally in the center, its anterior border very shallowly and broadly emarginate or concave. Eyes placed far back, just before the small, rounded, slightly projecting occipital lobes, the latter not so strongly projecting nor the eyes so sunken as in Smith's figure 12 (*loc. cit.*). Eyes themselves moderately large and convex, with much the same proportions as in Smith's figure.

[2a] Borgmeier, T., 1937. Arch. Inst. Biol. Veget. (Rio de Janeiro), III, pp. 245–246, figs. 30–33.

Alitrunk bulky and rather steep sided, the mesonotum dorsally only moderately convex; propodeal teeth low and subrectangular.

Petiole slightly arched or bent, with an anteriorly tapered peduncle and a prominent, thick node, slightly longer than its peduncle and with steep anterior and gently sloping posterodorsal faces. Peduncle beneath with seven ventrally directed acute spines unevenly spaced along the midventral line, the most anterior of these thicker than the rest. Postpetiole subequal in length to the petiolar node, low in profile, with a long, flat, sloping dorsal face which rises to a low rounded apex posteriorly and then drops slightly to its juncture with the gaster. Seen from above, the petiole is narrower than the postpetiole and is oblong in shape, while the postpetiole is subtrapezoidal, as broad behind as long, the sides diverging posteriorly and then very slightly narrowed so that it is attached to the gaster by nearly its entire breadth. Gaster long oval, its anterior border semicircularly excised to receive the postpetiole; first gastric segment forming the great bulk of the gaster, anteroventrally with a prominent low median ventral carina running longitudinally back from the anterior border.

Mandibles smooth and shining, with minute scattered punctulae. The center of the upper cephalic dorsum is raised in a large circular swelling, which is structural rather than merely a sculptural feature; this swelling has a deep concavity in the center, and thus forms a thick ring, in the posterior part of which is situated the anterior ocellus (just as Smith mentions) Surface of head rugulose, with deep, longitudinal punctures separating the ridges, the clypeus with very low, fine rugulation and punctation on the same pattern; the entire cephalic sculpture more or less concealed by the dense squamate pilosity. Alitrunk and coxae of forelegs with finer rugulation; the sides feebly shining and rather smooth, but covered for the most part with abundant and often crowded, but distinct, pin-point punctulae, as are also the nodes of the pedicel and the surface of the gaster.

Dorsum of head, outer basal parts of the mandibles, dorsum of alitrunk and nodes with small, brilliant, whitish, subappressed and appressed suborbicular spatulate hairs, densely arranged on head and antennal scapes, much less abundant on thorax and nodes. The squamate hairs tend to lie in and fill the punctures of the sculpture where these are deep. Appendages with abundant cream-colored subappressed spatulate or subspatulate hairs directed apically and becoming gradually more and more pointed toward the apices of

the members. Head posterior to the eyes, dorsum of alitrunk, anterior humeral faces of the thorax, nodes and gaster with fairly abundant short, erect, strongly clubbed hairs of a sordid whitish-yellow color.

General body color deep ferruginous red.

Single remaining forewing as in Smith's figure 13, but with a short spur remaining to represent the basal vestige of the apical (fourth) free abscissa of M (following the system of nomenclature of Ross, 1936).

This female otherwise agrees very well with the females and workers from British Guiana which Wheeler determined as *Basiceros singularis;* the antennal conformation is much the same, with the scape flattened and basally strongly and lobately or subangularly produced from the anterior margin.

Described from the lone *holotype,* a female (labelled *"Basiceros* n. sp") sent me by Father Thomaz Borgmeier of Rio de Janeiro. The specimen was collected by Schwarzmaier at Campinas, Goias State, Brazil, during October 1935. Type is to be returned to Father Borgmeier's collection with my hearty thanks for the privilege of studying this and other dacetines from the eminent Brazilian entomologist's collection.

It was noted above that I consider this to be the same form Frederick Smith described 89 years ago as the female of *Ceratobasis singularis,* the only doubt stemming from certain differences in Smith's figures, which are often inaccurate and vague. I do not know whether Ega is the proper locality for Smith's specimen, but seemingly it was taken somewhere in the Amazon Basin by the famous naturalist Henry Bates. Although Smith cautioned Bates, as he says, to keep good collecting records and proper associations of the castes of one species, it appeared that Smith himself had a perverse genius for mixing up these same records and associations as few have ever done. Most of Smith's locality records bear little examination, and it is not safe to accept them too specifically for types. Many previous authors have flayed the same hide while themselves committing errors as grievous, so it is perhaps best to let Mr. Smith rest in peace while his detractors have their well-deserved turn.

I know of no other forms properly referable to *Creightonidris* in addition to the genotype. The curious mandibles certainly lead one to wonder what the feeding habits may be like.

OCTOSTRUMA Forel

Rhopalothrix (*Octostruma*) Forel, 1912, Mem. Soc. Ent. Belg., XIX, p. 196.
Octostruma Brown, 1948, Trans. Amer. Ent. Soc., LXXIV, pp. 102, 125.

GENOTYPE.—*Rhopalothrix simoni* Emery (by designation of Wheeler).

In my 1948 paper, I separated *Octostruma* from *Rhopalothrix* on the basis of the seven-segmented antennal funiculi (eight antennal segments total) as opposed to the six-segmented funiculi of *Rhopalothrix*. I have studied the species of neither genus in detail, but I believe the generic distinction will hold. Of the many specimens of twenty-odd species I have examined in the two genera, there have appeared no intergrade freaks with incomplete segmentation such as make generic separation on the basis of antennal segment numbers doubtful in other formicid groups. The future reviser of this group will undoubtedly carry the splitting of both *Octostruma* and *Rhopalothrix* to a further extreme, since both contain some rather aberrant species. Listed below are the species and subspecies[8] of *Octostruma*.

balzani Emery
barberi Mann
batesi Emery
equilatera Weber
godmani Forel
iheringi Emery
lutzi Wheeler
petiolata Mayr
reichenspergeri Santschi
rugifera Mayr
simoni Emery
simoni subsp. *spei* Forel
simoni subsp. *sulcata* Santschi
simoni subsp. *wighti* Wheeler
truncata Forel
wheeleri Mann

The genus is completely restricted to the Neotropical region.

RHOPALOTHRIX Mayr

Rhopalothrix Mayr, 1870, Sitzb. Akad. Wiss. Wien, LXI, p. 415.

GENOTYPE.—*Rhopalothrix ciliata* Mayr (designated by Wheeler).

This genus is distinguished from *Basiceros, Creightonidris* and *Octostruma* by having only six segments in the antennal funiculus.

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[8] I have arbitrarily raised several forms heretofore considered as varieties to subspecific rank because I believe these forms must stand or fall as either subspecies or species. There is much evidence to indicate that the varietal rank in the Formicidae is based on unsound taxonomic principles and practices viewed from a modern biological standpoint, as Creighton will presently show in an extended discussion in his book on North American ants, now in press.

It differs from the three other genera with six-segmented funiculi (listed below) in having triangular or subtriangular serially dentate mandibles of the more common general basicerotine pattern.

In the New World, *Rhopalothrix* is represented by six tropical or subtropical species:

amoena Mann
bolaui Mayr
bruchi Santschi
ciliata Mayr
gravis Mann
schmidti Menozzi

In the Old World, the genus is represented by more numerous forms, several of which are rather large and highly decorated. Most of the species are concentrated in the Papuasian subregion, while a few have found their way into northeastern Australia and peripheral island groups like Fiji, Samoa and the Philippines. Dr. Keizô Yasumatsu of the University of Kyushu has sent me a female specimen taken by Dr. T. Kano on Botel-Tobago Island, which lies between Luzon and Taiwan. This is the most northerly record for the basicerotines in the Old World.

angulinodis Stitz
biroi Szabó
borneensis Wheeler
brevicornis Emery
elegans Mann
emeryi Forel
isabellae Mann
kokodensis Donisthorpe
manni Menozzi
mixta Szabó
procera Emery
procera subsp. *ballionii* Forel
procera subsp. *malua* Mann
procera subsp. *melanotica* Mann
procera subsp. *samoae* Santschi
punctata Szabó
subdentata Donisthorpe

Rhopalothrix redux Donisthorpe was described from the isolated male sex. The type came from British Guiana, so *R. redux* could conceivably belong to any one of several basicerotine genera or even to another tribe. Donisthorpe has described quite a few isolated males belonging to the "Dacetini" and other groups, a practice which is highly questionable in dealing with the dacetines, basicerotines and some other higher specialized myrmicine groups in which this sex is highly conservative. Unless and until such authors are willing to put forth adequate descriptions of male uniques which will include such necessary details as analysis of the venation of the forewing and figures of the genitalia, the addition of new names based on males alone can only add to the already considerable confusion of the taxonomy in the groups in question.

The roster of the basicerotine genera is completed by the three monotypic genera described from the New World tropics by Dr. Neal A. Weber within recent years. These are probably all related to *Rhopalothrix* or *Octostruma,* from which they are differentiated chiefly by means of rather extreme deviations in mandibular structure.

ACANTHIDRIS Weber

Acanthidris Weber, 1941, Ann. Ent. Soc. Amer., xxxiv, p. 188, pl. 1, figs. 4-7.

GENOTYPE.—*Acanthidris isthmicus* Weber (Monobasic, designated by Weber).

I have seen a specimen in addition to the type of *isthmicus,* but taken at the type locality on Barro Colorado Island, Panama Canal Zone (J. Zetek) and sent me by Dr. M. R. Smith. *Acanthidris* may be recognized by the long and very sharp spine situated on the inner mandibular border a short distance basad of the apex. Eyes are strongly reduced and very difficult to locate in the worker.

TALARIDRIS Weber

Talaridris Weber, 1941, Ann. Ent. Soc. Amer., xxxiv, pp 184-185, pl. I, figs. 1-3.

GENOTYPE.—*Talaridris mandibularis* Weber (Monobasic, designated by Weber).

Talaridris mandibularis is known so far only from the original localities in Trinidad and British Guiana. The genus is characterized by the sublinear, somewhat arcuate mandibles furnished apically with a short series of irregular teeth; the opposite mandibles meet only along these small apical masticatory borders when closed.

HEPTASTRUMA Weber

Heptastruma Weber, 1934, Rev. de Ent., Rio de Jan., iv, pp. 54-55, fig. 13, A, B.

GENOTYPE.—*Heptastruma wheeleri* Weber (Monobasic, by designation of Weber).

The genotype, so far the only known species of the genus, was taken in Cuba. The mandibles are strongly convergent, though *basically* dissimilar, to those of certain dacetines. The similarity is mainly due to the presence of an apical mandibular fork of two subequal spiniform teeth directed medially, much like those of *Strumigenys*, etc. The remainder of the head and body shows that this ant is probably related to *Rhopalothrix* and not at all closely to any dacetine genus.

The *Basicerotini* form a very compact group of ancient aspect, with possible relationships to *Stegomyrmex* and the *Attini*. Studies of the ethology, now totally or nearly totally unknown, should enable us to place them more satisfactorily. Studies of the wing venation and especially the genitalia in relation to the same features in other myrmicines should also furnish some solid clues to the phylogeny. Genitalia, in the few species I have examined, are totally unlike those of any dacetine male, but the males of so few other myrmicines are known from genitalic dissections that I cannot relate them properly to any other forms on this basis. The study of the basicerotine larvae may also furnish important phylogenetic evidence.

The tribe is ripe for a revisionary study, and such a study should not prove difficult. Types of the species are concentrated in the collections made by Emery, Forel, Mayr and Santschi, in European museums at the present; the early *Basiceros* material of Frederick Smith is at the British Museum, as are also Donisthorpe's species. Material is fairly abundant in the larger American museums, and types of most of the species of Wheeler, Mann, Weber, Menozzi and Borgmeier rest in the Museum of Comparative Zoology at Cambridge or in the private collections of those specialists mentioned who are still living.

I wish to thank Dr. M. R. Smith, Father Thomaz Borgmeier, Sr. Mario Consani and Dr. J. C. Bequaert for their aid in the matter of loans of basicerotine material.

Note.—The tribe Dacetini is seen to be altered considerably from the list in my preliminary revision (*op. cit.*, p. 102). I inadvertently omitted from that list two genera (*Codioxenus* Santschi and *Trichoscapa* Emery) which appeared and were treated at some length in the body of the paper; *Codioxenus* was also omitted from the generic key, in which it runs to couplet 28 on p. 128, but differs from both alternatives in possessing an oblong head with subparallel sides. There is so much new generic material soon to be published in this tribe that I have considered it advisable to wait until a later date before bringing out a revised list or survey of the genera of the Dacetini. Such a list will include many important recently published genera and subgenera and changes in the status of older ones, as well as those now in press.

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DERMAPTERA COLLECTED BY THE MANGAREVAN EXPEDITION

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(Text-figure)

Of the eight species of earwigs here recorded, one proved new to science, and five species are reported for the first time from various archipelagoes of Polynesia.

For a summary of the operations of the Mangarevan Expedition, with most important and valuable notes on the biota of the many islands examined, and the survival possibilities of the endemic animal and plant life on the same, the student is referred to Bulletin of the Bernice P. Bishop Museum no. 133, pp. 33–71, (1935).

A few records of material in the collection of the American Museum of Natural History, taken on islands visited by the Mangarevan Expedition, have been included for faunal completeness; in all cases these are indicated by the appropriate symbol (A.M.N.H.). Except for these, and a duplicate set retained by the Academy of Natural Sciences of Philadelphia, the material here recorded is contained in the collections of the Bishop Museum.

Except where otherwise specified, all material here listed was collected by E. C. Zimmermann.

PYGICRANIDAE

Anisolabis maritima (Géné)

1832. *Forficula maritima* Géné, Sagg. Monogr. Forfic. Indig., p. 9. [♂, ♀; shores of the Mediterranean between Nice and Tuscany.]

AUSTRAL ISLANDS: Rurutu; XI, 26, 1934; (Crocker Exped.); 2♀; [A.M.N.H.]. Raivavae; XII, 1–2, 1934; (Crocker Exped.); 1♀; [A.M.N.H.]. Rapa; XII, 7–9, 1934; (Crocker Exped.); 1♀; [A.M.N.H.]: quarter mile east of area, 150 feet; VIII, 1, 1934; 1♂, 3♀.

The previous Polynesian records of this widely spread species were from various of the small outlying islands of the Hawaiian group (reaching from French Frigate Shoal to Pearl and Hermes Reef) (Hebard, 1926), Midway Island (Hebard, 1926), Nassau Island southeast of the Samoan group (Borelli, 1928), and Tahiti (Cheesman, 1928). In all of these islands it probably is an accidental introduction, but the species is found widely distributed over the world in strand and similar environments.

Anisolabis annulipes (Lucas)

1847. *Forficelisa annulipes* Lucas, Ann. Soc. Entom. France, (2) v, Bull., p. LXXXIV. [Sex ? ;"Jardin des Plantes," Paris (introduced).]

SOCIETY ISLANDS: Papeari, Apirimaue Tuipi Bay, Tahiti; V, 10, 1934; 1 ♀. Near Vaitaare, Papeari, Tahiti; III, 24, 1934; 1 ♀. One and one-half miles N.E of Papeete, Tahiti; III, 1, 1934; 1 ♂, 1 ♀.

TUAMOTU ISLANDS: Tukuhora, Anaa Island; V, 12, 1934; 1 ♀. South side of Mt. Mokoto, Mangareva Island, 1000 feet elev.; VI, 2 and 6, 1934; (beaten from dead fei leaves); 3 ♀. Rikitea, Mangareva Island; XII, 16, 1934; (Crocker Exped.); 3 ♂, 4 ♀; [A.M.N.H.]. Northwest side of Henderson Island, 100 feet elev.; VI, 19, 1934; (beating) 2 ♂, 1 ♀. North side of Pitcairn Island; VI, 13, 1934; 1 ♀. Pitcairn Island; XII, 28, 1934; (Crocker Exped.); 1 ♀; [A.M.N.H.].

AUSTRAL ISLANDS: southwest ridge of Mt. Taita, Tubuai Island, 1200 feet elev.; VIII, 20, 1934; 1 ♀. Eastern slope of Mt. Muanui, Raivavaé Island, 500–800 feet elev.; VIII, 8, 1934; 1 ♂, 1 ♀. South ridge of Mt. Perahu, Rapa Island; VII, 13, 1934; 1 ♂. South slope of Mt. Tepiahu, Rapa Island, 400–600 feet elev.; VII, 16, 1934; 1 ad. ♂, 1 juv. ♂. Northwest slope of Mt. Tautauta, Rapa Island, 700–800 feet elev.; VII, 9, 1934; 1 ♀. Rapa Island; XII, 7–9, 1934; (Crocker Exped.); 1 ♀; [A.M.N.H.]. Northeast slopes of Mt. Tevaitahu, Rapa Island, 600–800 feet elev.; VII, 8, 1934; 1 ♂. Quarter mile E. of area, Rapa Island, 150 feet elev.; VII, 1, 1934; 1 ♂.

The above records are the first of this widely distributed species from the Taumotu archipelago. Previously it had been recorded in the main Pacific from Tahiti, a number of islands of the Marquesas group, Rapa Island in the Australs, New Caledonia, Palmyra Island, the Galápagos, Juan Fernandez and Easter Island.

In size there is a great deal of individual variation in the above representation, but most of the series are too limited to determine whether there is any definite geographic correlation of this variation.

LABIIDAE

Chaetospania abortiva [1] new species (Fig. 1.)

The unusual character of the wing-scales in this species prevents its confusion with any of those previously known forms of this rather extensive genus. In other respects I would compare it with three described species, two Asiatic and one Fijian, two of which, however, are not closely related to *abortiva,* but do show certain superficial similarities. From *C. infernalis* Burr,[2] of Formosa, the present species differs in the partly developed wing-scales, which are not apparent in *infernalis,* in the very evident and produced male pygidium, the more slender and elongate forceps of the same sex, and the shape of the pronotum and of the elytra. From *C. parvula* Burr,[3] of Borneo, *abortiva* differs in the partly developed wing-scales, which are also lacking in *parvula,* the narrower pronotum, the produced pygidium of the male, the different type of male forceps, and the more uniform coloration. From *C. stoneri* Caudell,[4] of the Fijis, with a pair of which from Nasogo, Fiji Islands, comparison has been made, *abortiva* differs in its average larger size and more robust build, in the development of the evident wing-scales, in the shorter elytra, the pair of which are little broader than the pronotum, in the produced lanceolate, instead of distally bispinose, male pygidium, in the less sharply hooked apices of the female forceps, and in the more uniform coloration.

The forceps of the male of *abortiva* more nearly resemble those of *stoneri* than of any other species of the genus which I have examined, and tentatively at least I would consider *abortiva* nearer *stoneri* than any other species of which I have seen material. The descriptions of all previously described forms of the genus not represented before me by material have been examined.

The future may show the necessity for division of the genus *Chaetospania,* as it is a most heterogeneous assemblage, the extremes of which have little in common. In addition the literature on the genus is greatly muddled.[5]

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[1] In allusion to the minor development of the wing-scales.

[2] Entom. Mitteil., II, p. 67, fig. 3, (1913). [♂, ♀; Kosempo, Formosa.]

[3] Ann. and Mag. Nat. Hist., (7) VI, p. 93, (1900). [♂; Kuching, Sarawak, Borneo.]

[4] Univ. of Iowa Studies, XII, no. 3, p. 5, fig. 1, (1927). [♂ (type), ♀; Suva, Fiji Islands (type locality); Colii, Suva, Fiji Islands.]

Type.—♂; Mt. Aorai Trail, Tahiti, Society Islands. Elevation, 4500–5500 feet. September 15, 1934. (E. C. Zimmermann.) [Bernice P. Bishop Museum.]

Size relatively large for the genus (overall length, 11.9 mm.[6]); form moderately depressed, in general outline regularly narrowing cephalad from the point of greatest width, which is at distal third of abdomen; surface in general moderately glabrous, of abdominal segments except anal one shallowly but closely and regularly cribroso-punctulate.

Head in outline broad and short pyriform, the greatest breadth across the eyes equal to seven-eighths of total head length, occipital outline very shallowly and broadly emarginate mesad, the same rounding laterad to the broadly arcuate lateral outlines, which include genae and eyes without break, the eyes not at all prominent and in length not greater than half of postocular length of genae; surface of occiput shallowly but appreciably and broadly subcircularly impressed on each side of a very low but distinct narrow medio-longitudinal ridge-like area; antennae with 13 articles, those distad of the third each elongate moniliform, third faintly enlarging distad, proximal 1.5 times the length of the third.

Pronotum slightly longer than broad, greatest (median) length to greatest breadth (caudad of middle) as 27 to 23.5, cephalic breadth slightly less than that across eyes; cephalic margin appreciably arcuate, latero-cephalic angles rounded obtuse, lateral margins nearly straight, very slightly diverging caudad to middle, subparallel in caudal half, latero-caudal angles rather narrowly but well rounded, caudal margin quite broadly and evenly arcuate, surface of cephalic half, except for narrow lateral intra-marginal longitudinal impressions, quite appreciably arcuate both transversely and longitudinally, with paired shallow but distinct impressions centered on each side of a very weak medio-longitudinal sulcation, caudal half of surface deplanate, relatively level within the lateral impressions except that mesad near the caudal margin it is faintly decurving caudad, while on the median line there is a shallow and narrow furcate rugula on cephalic portion of caudal half of surface.

Elytra with their greatest overall length slightly exceeding the median length of the pronotum (as 30 to 27), although the length of the lateral margin is slightly less than the median pronotal length (as 25 to 27); shoulders of elytra little projecting laterad of the pronotal margins, the lateral outline of same, as seen from dorsum, very faintly arcuate, nearly straight, distal margin obliquely arcuate, meso-caudal angle very narrowly arcuate, internal margins very narrowly overlapping in proximal two-thirds of their length. Exposed wing-scales narrow, extending caudad of the elytra on external side a distance equal to one-sixth of total tegminal length (as 5 to 30), apices of wing-scales, as seen from dorsum, subtruncate.

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[5] In describing *Chaetospania* in the Genera Insectorum in 1911 Burr (p. 54) gives as a generic character: "Elytra and wings perfectly developed," yet *C. parvula* Burr, one of the species there included, lacks evident wing-scales.

[6] This statement requires qualification when more than the type is considered, as the species shows a very decided size range, which is evidenced by the series of measurements given on a following page.

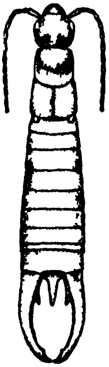

Fig. 1.—*Chaetospania abortiva* new species. ♂ (type). (× 4.)

Abdomen narrowly and evenly widening from base to eighth tergite, the breadth at latter being nearly twice that of pronotum (as 41 to 23.5) and 1.5 times that at base, which latter dimension is subequal to the median length of the pronotum, greatest width of abdomen faintly greater than that of anal segment (as 41 to 38); lateral folds indicated on third and fourth tergites; anal segment rectangulately transverse, its proximal breadth equal to 2.37 times its median length, lateral margins straight and parallel, distal margin shallowly trisinuate, with a very slight concavity, of faintly oblique trend, dorsad of the base of each forcep arm, and mesad a broader one over the pygidial base, surface of anal segment shallowly declivent meso-distad toward pygidial base, a shallowly impressed median line failing to reach both base and distal margin. Forceps three-fifths as long as the abdomen (minus forceps) distad of the elytral apices (as 60 to 100), arms slightly diverging in proximal third then evenly arcuate inward, and as a whole tapering evenly in thickness distad, apices attingent,[7] ventral surface deplanate, dorsal surface with a marked dorso-internal ridge in proximal half, this becoming obsolete and the dorsal surface progressively flattened distad, ventro-internal angle of surface bearing at proximal two-fifths of forceps length a distinct spiniform tooth, which is directed obliquely meso-distad, briefly preceding apex the internal surface bears a small but marked nodose tooth, apex subfalcately acute; pygidium acute lanceolate, reaching as far distad as the apex of the principal tooth on the forceps, proximal breadth contained 2.6 times in median pygidial length, form markedly hastate with distinct lateral acute points at proximal fifth, the lateral margins slightly diverging to these then

[7] Overlapping in one paratype.

regularly converging to the acute apex, dorsal surface of pygidium depressed in the greater part of its length, immediately proximad the pygidium is greatly increased in depth and the dorsal surface concavely rises to the proximo-dorsal articular border of the pygidium; subgenital plate but slightly less in extent than anal segment, distal margin broadly arcuate with a median infra-pygidial concavity.

Limbs as a whole relatively slender, but the cephalic and median femora inflated and subbullate, the cephalic more so than the median, cephalic subequal in length to pronotum; caudal femora proportionately slender, 1.6 times as long as pronotum, caudal tibiae five-sixths as long as femora (as 15 to 19), moderately compressed, caudal tarsi with metatarsus somewhat longer than the other articles combined.

Allotype.—♀; same data as type. [Bernice P. Bishop Museum.] Differing from the preceding description of the male (type) in the following noteworthy respects.

Size much smaller than in male type (overall length 7.8 mm.).

Head as in male except that the surface sculpture of the occiput described in that sex is subobsolete, in section the whole occiput being more definitely transverse low arcuate; antennae lacking.

Pronotum in general as in male, but lateral margins are straighter and as a whole faintly diverging caudad; surface not definitely divided into two sections as in male, a transverse median impression evident only laterad and not crossing median area, caudal half of surface not deplanate

Elytra and wing-scales as in male

Abdomen in outline slightly more fusiform than in male; anal segment appreciably narrower proportionately and less rectangulate than in male, evenly narrowing somewhat distad, distal margin subtruncate, mesad with a short suberect spiniform process, surface of anal segment immediately dorsad of insertion of the arms of the forceps narrowly strumose and here with fine shagreenous surface sculpture, median impressed line of anal segment as in male. Forceps about half as long as abdomen (minus forceps) distad of the elytral apices (as 34 to 70), the arms when in usual position converging and briefly overlapping at the apices, relatively stout, subdepressed, subequal in breadth to middle, then evenly narrowing to the slightly falcate apices, dorso-internal margin in proximal half with three spaced and obliquely directed teeth, these followed by a very narrow internal median longitudinal sublamellation to the apices, ventro-internal margin in proximal half with similar but less decided teeth; pygidium subquadrate, slightly longer than distal width, with convergingly concave lateral margins; subgenital plate with distal margin rather broadly arcuate.

Limbs of allotype damaged.

Coloration.—Ranging from hazel on caudal two-thirds of body (including forceps and pygidium), gradually passing cephalad to mummy brown on head (this in type), to entirely mummy brown except for the dark hazel forceps (allotype). The paratypes are nearer the dark phase seen in the allotype, but in one the forceps are lighter, nearer ochraceous-tawny, while in another the abdomen and forceps are chestnut-brown. In the type the femora are nearer dresden brown, with their immediate distal extremities and tibiae and tarsi ochraceous-tawny to ochraceous-buff, while in the other specimens the limbs as a whole are virtually uniform with the body in color; eyes of the head color; antennae dresden brown in the type, of the body color in the other individuals; mouth-parts dresden brown.

Measurements.—As the following dimensions (in millimeters) show, the species varies very greatly in size, particularly in the male sex, and in material from the same immediate locality.

	Overall length	Length of body (exclusive of forceps or pygidium)	Length of pronotum	Length of elytron	Length of forceps	Length of male pygidium
♂, Mt. Aorai Trail, Tahiti, *type*	11.9	8.9	1.35	1.55	3	1.2
♂, Mt. Aorai Trail, Tahiti, *paratype* ...	10.1	8.1	1.2	1.2	2.3	.95
♂, Mt. Aorai Trail, Tahiti, *paratype* ...	7.6	5.5	1	.95	2	.6
♀, Mt. Aorai Trail, Tahiti, *allotype*	7.8	6.5	1	1.05	1.65	—

Variation.—The above measurements evidence the very great size variation found in this species, and the marked color range is described under "Coloration." The length and development of the male pygidium is correlated with the same tendencies of the forceps, the pygidial apex reaching as far distad as the internal tooth of the forceps. In the smaller male paratype, i.e., the third in the above table, the portion of the pygidium distad of the paired lateral teeth of the proximal section is proportionately thicker, stouter and less evenly acuminate than in the other males seen, its apex being somewhat more blunt acute.

Paratypes.—I am indicating as paratypes two males, one bearing exactly the same data as the type, the other taken at the same place, on the same day and by the same collector, but at an elevation of 5500 to 6300 feet; also a specimen minus the abdominal apex but presumably a female, taken September 16, 1934, at the same locality and by the same collector at 5800 feet elevation.

Specimens examined: 5; 3 ♂, 2 ♀.

SOCIETY ISLANDS: Mt. Aorai Trail, Tahiti, elevation 4500–6300 feet; IX, 15–16, 1934; 3 ♂ (*type* and *paratypes*), 2 ♀ (*allotype* and *paratype*); [Bishop Museum and Acad. Nat. Sci. Phila.].

Labia curvicauda (Motschulsky)

1863. *Forfiscelia curvicauda* Motschulsky, Bull. Soc. Imp. Nat. Moscou, XXXVI, pt. II, p. 2, pl. II, fig. 1. [♂, ♀; Nura Ellia [Nuwara Eliya] Mountains, Ceylon.]

SOCIETY ISLANDS: Arue, Tahiti; III, 6, 1934; (in rotten papaya stump); 1 ♂, 2 ♀. Papeari, Tiupi Bay, Tahiti; V, 3, 1934; (beneath cocoanut frond on tree); 1 specimen minus apex of abdomen. Fatia-po, Mutia Island, 500–900 feet elevation; V, 12, 1934; 1 ♀.

This circumtropical species has already been reported from Moorea, Tahiti and Raiatea of the Society group by Cheesman in 1928 and Hebard in 1933. Undoubtedly its broad distribution has been caused by accidental introduction.

Labia dubronyi Hebard

1922. *Labia dubronyi* Hebard, Occas. Papers Bernice B. Bishop Mus., VII, p. 318, pl. XXVI, figs. 5–7. [♂ (*type*), ♀; Ookala, Hawaii; Hanula Valley (type locality), Opaeula Gulch, Makaleha Valley and Kuliouou, Oahu, all in the Hawaiian Islands.]

TUAMOTU ISLANDS: North-west Islet, South Marutea Island; V, 22, 1934; 1 ♀.

AUSTRAL ISLANDS: quarter mile east of area, Rapa Island, 150 feet elevation; VII, 1, 1934; 1 ♂. South slope of Mount Tepiahu, Rapa Island, 400–600 feet elevation; VII, 16, 1934; 2 ♀.

These individuals have been compared with the type and other authentic material of the species from the Hawaiian and Marquesan archipelagoes. Menozzi has reported it from Ponape Island, eastern Carolines,[8] and probably the species is of relatively broad distribution in Polynesia and Micronesia. The above are the first records of the species from the Tuamotu and Austral groups.

Labia swezeyi Hebard

1932. *Labia swezeyi* Hebard, Entomological News, XLIII, p. 31, fig. 1. [♂ (*type*), ♀; Mount Kaala, Oahu, Hawaiian Islands, elevation 2000 feet.]

AUSTRAL ISLANDS: northwest slope of Mt. Tautauta, Rapa Island, 700–800 feet elevation; VII, 9, 1934; 2 ♀. Northeast slopes of Mt. Tevaitahu, Rapa Island, 600–800 feet elevation; VII, 8, 1934; 1 ♂, 1 ♀.

This is the first record of the species from outside of the island of Oahu of the Hawaiian group, and the material here recorded has been compared with the type and allotype, which are now before me. The characters of the species and those distinguishing it from *L. dubronyi* have been fully set forth in the original description.

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[8] Mushi, XIII, p. 74, (1941).

From the limited knowledge we possess of the conditions under which *swezeyi* has been collected, it would appear restricted to habitats which are virtually undisturbed, and probably the species will be found much more widely distributed in suitable environments of other Polynesian islands.

CHELISOCHIDAE

Hamaxas nigrorufus (Burr)

1902. *S*[*pongiphora*] *nigrorufa* Burr, Termes. Fuzet., xxv, p. 480, pl. XX, fig. 3. [♂, ♀; Stephansort, Astrolabe Bay and Simbang, Huon Gulf, New Guinea.]

SOCIETY ISLANDS: Fautaua Valley, Pare, Tahiti; V, 7, 1934; 2♀. Arue, Tahiti; III, 6, 1934; 1♀.

These specimens have been compared with Hawaiian material reported as this species by Hebard in 1922,[9] agreeing in characters and size with the same, and with comments made at that time by Hebard. The Tahiti individuals have also been compared with a single female, in the Academy collection, from the Mount Lamington District of Papua,[10] which was later reported as *nigrorufus* by Hebard, who at the same time assigned the species to *Hamaxas*.[11]

Existing records of the species cover localities extending from the Key Islands and eastern New Guinea to the Hawaiian and Society groups. It was recorded from Raiatea in the latter by Miss Cheesman in 1928.[12] The individuals from the latter locality were said to have been in flight in numbers, apparently disturbed by the recent cutting of low scrub in a vanilla plantation.

Chelisoches morio (Fabricius)

1775. [*Forficula*] *morio* Fabricius, System. Entom., p. 270. ["Insulae Otaheita maris pacifici" [Tahiti].]

SOCIETY ISLANDS: Raiatea Island; 1926–1927; (J. W. Moore); 3♂, 5♀, 2 juvs. Northwest ridge of Mt. Turi, elevation of 1700–2160 feet, Huahiné Island; X, 1, 1934; 1 juv. North ridge of Mt. Teahurua, elevation of 1500–2000 feet, Mooreá Island; IX, 25, 1934; 1 broken adult. Mooreá Island;

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[9] Occas. Papers Bernice P. Bishop Mus., VII, p. 323.
[10] VII, 1927; (C. T. McNamara).
[11] Mem. Queensland Mus., x, p. 151, (1933).
[12] Ann. and Mag. Nat. Hist., (10) I, p. 170.

1 ♀; [Amer. Mus. Nat. Hist.]. Papeete, Tahiti; X, 2, 1899; 1 ♀; [A.N.S.P.]: X, 12, 1929; (Pinchot Exped.; H. A. Pilsbry); 1 ♀; [A.N.S.P.]. One and one-half miles northeast of Papeete, Tahiti; III, 2, 1934; (sweeping grass); 1 juv. Taunoa, Papeari, Tahiti; V, 6, 1934; 1 ♂. Tuipi Bay, Papeari, Tahiti; III, 21, 1934; 1 juv. Apirimane Valley, Tuipi Bay, Papeari, Tahiti; V, 4, 1934; 1 ♂, 1 ♀. Fautaua Valley, elevation of 300–700 feet, Tahiti; III, 3–13, 1934; 5 ♂, 4 ♀, 1 juv.

TAUMOTU ISLANDS: Northern islets, Timoe Island; VI, 25, 1934; 1 ♂, 2 juvs. Aukeua Islet, near Mangareva; V, 25, 1934; (sweeping grasses and low herbage); 1 juv. Northeast islet, Maria Island, elevation of 5 feet; IX, 6, 1934; 1 ♂. North side of Pitcairn Island; VI, 13, 1934; 2 ♂, 2 juvs. North side of Henderson Island, elevation 100 feet; VI, 17, 1934; 1 juv. Northwest side of Henderson Island; VI, 16, 1934; 2 juvs.

AUSTRAL ISLANDS: Tapapatauai Islet, Tubuai Island, elevation of 5 feet; VIII, 19, 1934; 1 ♀. Rautauro Islet, Tubuai Island, elevation of 5 feet; VIII, 19, 1934; 1 juv. South slope of Mt. Araua, Raivavaé Island, elevation 1000 feet; VIII, 14, 1934; 1 ♂, 1 ♀. Mt. Auatonu, Raivavaé Island, elevation 500 feet; VIII, 10, 1934; 1 ♂. Raivavaé Island; XII, 1–2, 1934; (Crocker Exped.); 1 juv.; [A.M.N.H.]. South ridge of Mt. Perahu, Rapa Island; VII, 13, 1934; 1 juv.

The present representation of this widely spread Indo-Pacific species shows the usual size variation in both sexes, and the forceps dimorphism of the male. The Raiatea series averages large in size, while the following measurements (in millimeters) illustrate the size range found in certain of the series.

	Length of body (to base of forceps but exclusive of same)	Length of forceps
♂, Raiatea Island	15.8	5.5
♂, Raiatea Island	18.7	5.7
♂, Fautaua Valley, Tahiti	12.8	3.9
♂, Fautaua Valley, Tahiti	14.6	5
♂, Raivavaé Island	15.4	6.3
♂, Raivavaé Island	17.2	6.8
♂, Pitcairn Island	13.3	4.9
♂, Pitcairn Island	14.6	4.9
♀, Raiatea Island	16.1	5
♀, Raiatea Island	18.7	5.7
♀, Fautaua Valley, Tahiti	12.3	4.8
♀, Fautaua Valley, Tahiti	17.1	4.9

Two males, one from Taunoa, Papeari, Tahiti, and the other from the northern islets of Timoe Island are of the brownish tone occasionally encountered.

In none of the individuals with perfect antennae is the pale annulus of the same lacking, although variable in breadth.

Apparently the present records are the first of the species from the Austral group, although previous ones attest the occurrence of *morio* in the Marquesas, Society and Taumotu archipelagoes.

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DERMAPTERA RECORDS FROM GUAM

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In Part II of the "Insects of Guam" (1946) [1] Mr. Swezey presented records of three species of Dermaptera from that island,[2] and stated that other material of that order, and of the Orthoptera, was in my hands for study, and had not been reported upon. The records here presented include all for the Dermaptera from Guam submitted by the Bishop Museum. To these have been added a few for the island from material belonging to the Academy of Natural Sciences of Philadelphia, and to the American Museum of Natural History. The present records add two previously unrecorded species to the Guam earwig fauna, in addition to one quite striking and apparently endemic form of the genus *Nesogaster,* which was described several years ago on the basis of material in the present series.[3]

Family LABIDURIDAE

Euborellia plebeja (Dohrn)

L[abidura] plebeja Dohrn, Stett. Entom. Zeit., XXIV, p. 322, 1863. [♀; Java.]

Piti, September 26, 1936, (Swezey, in tunnel of corn borer), 1 ♀. South of Tumon, August 25, 1945, (R. Chaffee), 1 ♀, [A.N.S.P.].

These specimens, with one male and two females of this species taken on Saipan, in the Marianas, May 7, 1945, by R. Q. Bliss, and now before me in the Academy collection, are the first of this widely distributed species reported from the Marianas. These records, and that of Borelli in 1928 from Apia, Upolu, Samoa, present our entire information on the occurrence of *plebeja* in the Pacific east of New Guinea. These specimens have been compared with material of the species from a number of localities in India,

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[1] Bull. 189, Bernice P. Bishop Mus., p. 8.

[2] I.e. *Euborellia annulipes, Labia curvicauda* and *Chelisoches morio.*

[3] Proc. Acad. Nat. Sci. Phila., XCVIII, p. 226, (1946).

Ceylon, China, Japan, Sumatra and various others in the Old and New Worlds, including one male from the Cosmoledo Atoll in the Indian Ocean, determined by Burr.

Family LABIIDAE

Nesogaster reditus Rehn

Nesogaster reditus Rehn, Proc. Acad. Nat. Sci. Phila., XCVIII, p. 226, figs. 6 and 7, 1946. [♂, ♀; Piti, Guam, Marianas.]

Machanao, June 4, 1936, (Swezey, under bark), 1 ♀. Yigo, October 18 and November 13, 1936, (Swezey, from dead small leaf ficus and in rotten bamboo stem), 1 ♂, 2 ♀, 1 specimen minus abdomen. Dededo, September 7, 1936, (Swezey, under bark), 1 ♀, 1 juv. South of Tumon, June 30, 1945, (R. Chaffee), 1 ♂, [A.N.S.P.]. Fadian, September 18, 1936, (Swezey, in rotten log), 2 ♀, 1 juv. Agana, May 25, 1936, (Swezey, in part from cocoanut log), 3 ♀, 2 juvs. Piti, August 19, September 6, October 6 and 27, and November 3, 1936, (Swezey, under bark, in garden, in rotten wood, in rotten board on ground, in rotton bamboo sprouts), 4 ♂, 7 ♀. Mt. Alifan, May 26, 1936, (Swezey and Usinger, in rotten bamboo stem and in papaya log), 1 ♀, 4 juvs.

This apparently endemic species was based on the series here recorded, and its nearest relatives are species from the mountains of Davao Province, Mindanao, Philippines.

Labia pilicornis (Motschulsky)

Forfiscelia pilicornis Motschulsky, Bull. Soc. Impér. Nat. Moscou, XXXVI, part 2, no. 3, p. 2, 1863. [♀; Mountains of Nura-Ellia, Ceylon.]

South of Tumon, August 12 and 20, 1945, (R. Chaffee), 2 ♀, [A.N.S.P.].

This is the first record of this quite broadly distributed Indo-Pacific species from the Marianas. The previous records from Pacific areas are from Tahiti (Hebard, 1933), the Samoan group (Borelli, 1928), the Fijis (Caudell, 1927, as *Labia* species), the Marquesas (Hebard, 1933), and the Hawaiian Archipelago. Material of *pilicornis* now before me represents localities reaching from Pusa, Bihar, India, to Sumatra (Fort De Kock), and eastward to various places in the Hawaiian, Marquesan and Society groups.

Family CHELISOCHIDAE

Chelisoches morio (Fabricius)

[*Forficula*] *morio* Fabricius, System. Entom., p. 270, 1775. ["Insula Otaheita maris pacifica." [Tahiti].]

Agana, July 6 and 9, 1920 (flying), 1 ♂, 1 ♀, [A.M.N.H.].

This widely distributed Indo-Pacific species has been recorded from a number of localities in Guam (Swezey, 1946), from Saipan (Menozzi, 1941), and from a number of islands in the Carolines (Gunther, 1933 and Menozzi, 1941).

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WING VENATION AND THE PHYLOGENY OF THE FORMICIDAE[1]
(HYMENOPTERA)

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(Plates VIII and IX)

INTRODUCTION

The wing venation of ants is a valuable taxonomic tool, but its full potentialities are far from realized. Former myrmecologists have utilized the cells of the wing as a systematic aid, while the veins which bound and form the cells have received little attention. As should be made clear by the discussion below, the lack of attention to the veins themselves has warped and hindered the entire approach to the subject. The reason for the old approach probably can be found in the inconsistencies among former attempts at homologizing the wing veins of the entire order Hymenoptera. Without a guiding homology, myrmecologists have fallen back on an arbitrary system or systems of wing vein nomenclature which often differed in details from author to author and from genus to genus. Rohwer and Gahan (1916) have illustrated the confusion which has reigned in the past among various hymenopterous groups.

Attempts at founding a secure homology of the primitive hymenopterous wing have more recently met with what seems to be a high degree of success. The work of Ross (1936) is accepted here as the logical starting point for analysis of the formicid venational elements. Those wishing to follow this paper back to its logical origin should by all means see Ross' lucid explanation and helpful figures. At least three other workers have recently accepted Ross' paper as a basis for homologizing venation in other groups within the Hymenoptera, and there seems to be no reason why the wings of all or most of the families of the order will not eventually be brought into proper relationship on the same basis.

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[1] We are greatly indebted to Dr. F. M. Carpenter, who originally inspired this investigation and who has aided greatly in ways too numerous to mention. We also wish to thank Dr. J. C. Bequaert and Dr. P. J. Darlington, who read the manuscript and suggested certain changes.

Another factor hindering the development of an adequate venational nomenclature in the ants has been the much-lamented variability of the pattern in many of the common forms. Some species of *Lasius* and *Aphaenogaster,* for instance, show great variation in presence or absence of major vein-elements and in the positions of important veins. It is our observation, however, that the degree of instability shown by such well-known forms does not extend to all the species of the Formicidae. Some whole genera show a highly constant pattern which is followed by all species examined; other genera show venational variation which is constant for the species, but varying from one species to another. A large number of species are variable within strict limits, and in many, a constant difference is shown between male and female.

The great emphasis on instability is misleading since the very genera which often show a high degree of venational variability are usually those which are most variable in other characters as well. Inasmuch as many of these are predominantly holarctic-dominant groups, they have been the first to come to the attention of European and North American specialists, and these specialists have naturally formed a bias against the taxonomic employment of the venation. Even in the holarctic-dominant genera and subgenera, with their unstable and apparently rapidly evolving populations, we need not abandon the use of venation as a legitimate taxonomic instrument. These very species often furnish fine examples of venational evolution in progress, as Emery has intimated on several occasions. The fact that we often cannot use venation as a hard and fast key character does not alter the promise of the wings in phylogenetic studies.

Emery has (1913) already made a promising start in the use of wing venation in defining large groups such as tribes; his classification, as set forth in his monumental contribution to the Genera Insectorum (1910–1925), relies heavily on the wings. Emery and his contemporaries were, as mentioned above, seriously hampered by lack of attention to the veins themselves and by the absence of a proper homology of the hymenopterous wing elements.

We cannot here profitably discuss the differences between our system of nomenclature and that formerly employed in treating ant wing venation; the interested reader may gain the best comparisons by putting figures like those given by Emery (1913), Wheeler (1908) or Donisthorpe (1927) next to our plates and comparing vein for vein.

HOMOLOGY OF FORMICID FOREWING VENATION

In applying the nomenclature of Ross to the ant wing, we must consult Ross' figures (1936, pl. 1, figs. 5, 9) and then wings of some ants considered primitive on other morphological (and ethological) grounds. We should naturally turn first to the Myrmeciini, since these have been stated by many authors to possess qualifications on many counts as the most primitive or generalized of living ants. *Promyrmecia* (our fig. 3), a common myrmeciine ant from Australia, does show a relatively liberally veined wing compared to some other ant genera. The weak vein labelled *1r* is present in many *Promyrmecia* and *Myrmecia* species; it is present and constant in position in such a large percentage of the myrmeciine specimens in the Museum of Comparative Zoology collections that we cannot consider it a mere adventitious anomaly. Furthermore, *1r* is indicated in part or entirely in other tribes of the Ponerinae, the sub-family among ants which has received the most consideration as the parent group from which the other subfamilies have arisen.

We have selected another primitive ponerine, *Platythyrea,* as a convenient type to display the chief venational features occurring in the ant wing (figs. 1 and 23). *Platythyrea* shows practically the same venation as do the myrmeciines, and the parts appear to be strictly homologous in both groups. In fig. 1, an interesting feature is the presence of the stub labelled *Rsx,* a fairly common and probably atavistic anomaly found in lower ponerine genera like *Myrmecia, Promyrmecia, Amblyopone,* etc., as well as *Platythyrea.*

Working directly, we may identify all the veins in the ant wing without difficulty until we reach the apical stretches of the radial sector and median veins (so-called). Ross admits the difficulty of properly homologizing the veins of this area, and we can add nothing to the certainty of such homologization. We have named the two veins *Rs* and *M* in an arbitrary manner. Because of the sporadic occurrence of the stub we call *Rsx* in the lower ponerines, it appears possible that our *Rsf5* represents the same vein that Ross, in his figure of the hypothetical generalized hymenopter, calls *Rs1*. Ross' *Rs2* would then correspond very nicely to our *Rsx,* which is connected to *M* by the crossvein we label *r-m* as a direct correspondence with the similarly positioned vein in Ross' fig. 5.

The treatment of this vein (*r-m*) involves some uncertainties, especially since we have found disagreement between such other clistogastran families as the Tiphiidae, Mutillidae, and Plumariidae in the venation of the area in question. The first- and last-named families are represented here by their respective genera *Anthobosca* (fig. 2) and *Plumarius* (fig. 7). Both of these forewings are very ant-like in venation, and there seems to be a close relationship on other anatomical grounds between at least the first of these and the primitive ants. The first radial crossvein (*1r*) is present in a weakened condition in many Tiphiidae (subfamilies Anthoboscinae, Myzininae, Thynninae), and the common primitive characters of antennal segment numbers (13 in male, 12 in female), development of first antennal segment into a lengthened scape, tendency toward separation of the first postpropodeal segment from the remainder of the gaster by a constriction and toward loss or weakening of the wings in the female sex, etc., etc., are evidences of a close relationship between the tiphiids and the ants. We may also mention ethological features possessed in common by both Formicidae and Tiphiidae, and it is this sort of thing that Wheeler stressed (1928) when he indicated the tiphiids as his choice for the logical ant ancestors.

In choosing an ant ancestor on largely ethological grounds, however, one may easily miss the point that habits and habitat, while often affirming morphological similarities between two groups, can just as easily be the basis upon which convergent anatomical details are formed. While we do not suggest that the striking points of morphological similarity between the tiphiids and the ants are necessarily all convergent ones, we do point to the venational pattern of the apical section of the ant wing, especially to *Rsx,* to show that the ants cannot easily be derived from any member of the true Tiphiidae recent or fossil. An examination of a specimen each of Cockerell's Florissant (Miocene) genera *Geotiphia* and *Lithotiphia* shows that Turner (1912) was probably correct in assigning the former to *Anthobosca;* certainly there is nothing about the fossils to suggest that they are very different from recent types of tiphiids occurring in other parts of the world, or that they are protoformicids. Pate (1947) reviews the subfamilies of the Tiphiidae and suggests that the Anthoboscinae are closest to the ancestral type of that family. Bradley (in Wheeler, 1933, pp. 104–105) suggests that the Anthoboscinae are to be regarded as the most likely ant precursors. Reid's (1941, pp. 417–418) discussion and diagram, based largely on a study of thoraces of wingless hymenopters, also suggests a tiphiid-like ant ancestor.

In the face of the large body of opinion holding like views, we will agree only to the statement of Reid: "Tiphiid-*like.*" We do not believe that the common ancestor from which probably arose the tiphiids and the ants would today necessarily be recognized as belonging to the family Tiphiidae.

The correspondence of *Rsx,* the apical stub considered above, may or may not be with the so-called *accessory* vein of the Mutillidae. If this correspondence is valid, then the ants must be considered as having lost *2r-m* and retained *3r-m,* which is the site of attachment of the accessory vein in the mutillids. The accessory vein is possibly the tip of a branch of *Rs.* If this is so, then the anterior half of *"3r-m"* would be a part of this same branch, while the posterior half would represent the true *3r-m.* Similar difficulties show themselves in the same region of the wing of *Plumarius* (fig. 7), a wing which otherwise agrees nicely with those we have been considering.

A study of the concave wing folds, thought to be rudimentary veins in the apical section of the wing, will probably some day lead to a solution of the homologies of this section of the aculeate forewing. For practical purposes, such a solution does not presently greatly concern us. Whether the vein we have labelled *r-m* represents the primitive *2r-m* or *3r-m,* or a combination of one of these and part of *Rs,* there is one fact we are reasonably sure of: this is the only one of the veins remaining to the ant wing which has any possible claim to be considered part or all of any *radio-median* crossvein. Among ants, therefore, it seems best to designate this vein simply as *r-m,* a practice we have followed. In ants, with the possible exception of some anomalous stubs projecting posteriorly from *M* in *Dorylus* species (fig. 11) and in occasional specimens of *Amblyopone* (camera lucida sketches by J. Clark *in litt.*), there remains no trace of *2m-cu,* a vein characteristic of tiphiids. The latter vein is lacking in *Plumarius* and many Mutillidae we have examined, but other morphological considerations would seem to rule out the latter family as being ancestral or even very closely related to the ants. The male of *Plumarius* is certainly not a very promising candidate for ant ancestry, since the species we have seen lack a number of the requisite protoformicid features. We do not know the female of *Plumarius;* as a matter of fact, very little is known about either morphology or ethology of the small group to which *Plumarius* belongs. (See Bischoff 1913, Brues 1924, Bradley 1921.) A study by some future worker may prove us wrong, but on the basis of our present study, we would place *Plumarius* at some distance from the ants in a phylogenetic sense. We have also examined two species of *Rhopalosoma,* which has an ant-like wing venation and certain suggestive body features, but this genus likewise is not considered by us to be very close to the ants. Other families examined have all proven merely suggestive of formicid affinities; in fact, it is surprising how many families of Hymenoptera have the first postpropodeal segment set off partially or wholly from the remainder of the gaster by a constriction, a character which is often considered diagnostic of the Formicidae. Many of these families are further possessed of quite ant-like wings in at least some genera, making the task of proving relationships quite difficult. Our conclusion as to ant ancestry postulates an early split in a line from which both the formicids and anthoboscines arose, the latter either giving rise to, or arising very close to, the stocks of the Thynninae and other tiphiids. We do not support the view of Wheeler (1928) and Haskins (1939) that the ants arose from a "bethyloid" stock. Although we will admit that it seems likely that the ethological background of the protoformicids and bethylids expresses some relationship between the two families, these are by no means the only families which can be placed in a large group of wasps sharing basic similarities in habits; the bethylids form a relatively small and specialized part of this group.

Other than the losses already noted which have combined to produce the ant venation, the only major change noted from Ross' fig. 5 involves the loss of all the veins in the anal region but *1A*. It would seem practical to call this vein *A* when dealing with strictly intraformicid taxonomy. Most of the families which could conceivably be closely related to the ants show similar reduction in the anal area of the forewing.

We have not investigated the hindwings very extensively. Figs. 22 and 23 illustrate the hindwings of *Anthobosca* and *Platythyrea* respectively. In the ant, *r-m* and *cu-a* are drawn back to the basal half of the wing; otherwise, the ant and *Anthobosca* are quite similar. We have not shown the hamuli, which are present in an irregular subbasal set and a more regular and compact preapical set. A detailed investigation of modification of both venation and the hamuli of the hindwing will possibly be of value in elucidating phylogeny within the Formicidae, but we cannot undertake such a study here.

In using the forewings as they betray relationships among the hymenopterous families and genera, the assumption is that progression from the generalized to the specialized is a matter of essentially irreversible reduction, fusion, or outright loss of venational elements. This seems to hold true among ants. Once a vein or section thereof is lost, it never reappears in succeeding generations except as an "atavism" marked by great instability of form and position, and one which often is absent from most specimens of the species in which it occurs. "Reappears" may, in fact, be the wrong word, since it is probable that the genetic factors responsible for the "atavisms" are carried in some form even in populations where the overt expression of the character is infrequently or never observed.

DEVELOPMENT OF VENATION AMONG THE SUBFAMILIES OF THE FORMICIDAE

Having established in a reasonably satisfactory manner the primitive wing venation, let us see what happens to the wings among the more specialized ants. In searching through a large collection, such as the one resting in the Museum of Comparative Zoology, we concentrated first upon the task of locating forms which had relatively primitive, i.e., unreduced wing venation. We succeeded in finding species in the subfamilies Dorylinae, Pseudomyrminae, Myrmicinae and Dolichoderinae which possessed all the abscissae found in *Myrmecia* and *Platythyrea* except *1r* and *Rsx*. In the Dorylinae, furthermore, *Cheliomyrmex* (fig. 8) showed occasional specimens in which *1r* had been retained as a well-marked vein. Many ponerine genera were found also to conform to this generalized plan, as would be expected. In most, if not all cases, the genera containing species with liberally veined wings were those considered primitive in their respective subfamilies by other authors, on grounds other than wing venation.

From the primitive types in each subfamily, reaches a graded series of ever more poorly veined wings, the loss of elements in certain species being very nearly complete. A closer study of the series at hand shows that reduction takes place in a usually similar and quite orderly way in different subfamilies and tribes. The same stages in reduction of selected members of different subfamilies may offer startlingly similar patterns, as witness figs. 4, 9, 12 and 18, then 13 and 19, then 17 and 20. Although the process of reduction shows many irregularities in detail among the subfamilies, it will perhaps prove valuable to review the usual kind of progressive change as a more or less general phenomenon. The interesting exceptions will be discussed later.

The first elements to be lost are the crossvein *1r* and the stub *Rsx*. *Messor* (fig. 13) shows an angularity of the radial sector and sometimes the suggestion of a spur which probably is to be accounted for by the former presence of *1r*. A very early change of a less noticeable character is the slow fusion of the base of *Mf1* along *CuA* until it is found to diverge from *CuA* distad of crossvein *cu-a*. This movement is highly significant to our discussion, since the origin of *Mf1* distad of *cu-a* is almost certainly a situation derived from one in which *Mf1* arose proximad of *cu-a*. This set of circumstances is amply demonstrated by reference to Ross' figs. 3, 5 and 9 and our figs. 2, 3, and 6 to 11.

The species of the Myrmeciini (fig. 3), certain primitive members of the Amblyoponini, and Carpenter's fossil *Eoponera* (fig. 6) show the intermediate situation where *Mf1* is lined up or nearly lined up at its base with *cu-a.* This condition is very constant in, and highly characteristic of, the myrmeciines as shown by a large number of specimens of many species. The species of the Dorylinae (figs. 8–11) without exception show *Mf1* as a very oblique vein arising well proximad of *cu-a.* All of the members of the higher subfamilies which we have seen (with the exception of a few degenerate types like *Basiceros* and its relative *Rhopalothrix* in the Myrmicinae) plus by far the great majority of the Ponerinae and all cerapachyines, show *Mf1* branching from the cubital vein distad of *cu-a.* The facts of venation to this point seem to show that the Dorylinae split off from the main formicid stock at a very early date, and that they cannot easily be derived from the ponerines. The dorylines may even represent a separate line derived independently from that which gave rise to the ponerines and higher subfamilies. An interesting corollary to this theory, and one we shall enlarge upon further below, is the strong probability that the relationship assumed to exist between the cerapachyines and the dorylines is mistaken.

If we ignore the dorylines for the moment and turn again to the general trends of venational reduction seeming to run parallel in the different subfamilies, we observe that the next step is the contraction of *Mf2.* To see how this happens, consult the following pairs of figures: 12 and 13, 18 and 19, 4 and 5. The latter pair of figures also illustrates part of the next step: the base of the vein representing the second and third free abscissae of *Rs* has begun to fuse along the basal part of *Mf3,* fig. 5. The relative scarcity of species showing the stage represented in figures 5, 13 and 19 seems to indicate that the situation following complete contraction and loss of *Mf2* is a highly unstable one calling for further readjustment of adjacent vein-elements. This readjustment may take a number of forms, but in essence, it involves reduction of the two veins stretching from the distal end of *Rs+M* to *r-m* to a single vein. This seems usually to be accomplished by the fusion of *Rsf2·3* with *Mf3* from the base outward (fig. 5) or by the disappearance of *Rsf2·3* by "withering" either piecemeal (fig. 14) or all at once, as is suggested by the weak appearance of this vein in forms like *Stigmatomma rothneyi* (Forel). Another possibility, suggested by certain forms related to *Aphaenogaster,* is that *Mf3* may drop out. This is probably rarer than loss of the part of *Rs,* but *Veromessor* (fig. 15) and *Novomessor* often show stubs which suggest that it may occasionally happen.

During or just before the loss of this longitudinal element, whichever part it may be that is lost, there is an important change in which the crossveins *2r* and *r-m* become approximated and continuous, or "lined up." This lining-up usually involves the contraction of the fourth free abscissa of *Rs,* but in some cases (*Amblyopone*), *Rsf4* may become aligned with, and persist as a part of, the *2r·r-m* complex abscissa.

The next step involves *r-m,* which usually does one of two things. It can either contract directly to produce the pattern characteristic of the Formicinae and many Dolichoderinae and Myrmicinae, figs. 17, 20, 21, or it can swing[2] so as to become aligned with *Mf3,* as in many small myrmicines, etc., figs. 16. Beyond this, reduction may proceed in several directions, though *m-cu* (or *Mf1,* as illustrated in figs. 20 and 21) and *cu-a* are among the earliest losses. The stages illustrated in figs. 17, 20 and 21 seem to be rather stable, as evidenced by the large number of ants which have gone to, but not beyond, this form of reduction.

Radical reduction in body size seems to upset the stability of even this pattern and to be correlated with still further reduction. The adoption of strongly hypogaeic habits also seems to foster reduction in all subfamilies, and parasitic forms often show radical reduction probably correlated with weakened powers of flight.

Extreme reduction is seen in *Leptanilla* among the genera allied to the dorylines, among certain small degenerate ponerine genera like *Probolomyrmex* and *Ponera,* and among several groups in the higher families such as the higher dacetine genera. We have observed, as have other workers, that single tribes or genera may run nearly the whole gamut of the reduction series, while other tribes and genera display uniform venation through all their species. This has raised a great deal of mistrust of wing venation as a taxonomic character, an attitude on the part of myrmecologists which is probably healthy as long as it does not reach the extreme where venational characters are utterly rejected. The veins, it must be remembered, are subject to change just as are mandibles, antennae, petioles and other structures which may show a wide range of variability within a single genus. The emergence of other structural characteristics which are sufficiently distinct to place a species in a new genus or tribe should not always be expected to show correlation with a striking venational change; rather, the opposite seems often true in ants. It should not be forgotten that specialization is differential; three or four clear-cut and taxonomically useful characters usually do not spring into being simultaneously to produce a new genus.

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[2] There is evidence that some myrmicines (*Aphaenogaster mariae,* etc.) may lose *r-m* completely, while keeping the central part of the radial sector. This produces a pattern like that in our *Octostruma,* and it may be that in all or most myrmicines which have arrived at this stage the vein we have labelled *r-m* in fig. 6 is really *Rs2·3.*

A SHORT SURVEY OF VENATION DETAILS IN VARIOUS FORMICID GROUPS

Dorylinae and Leptanillinae

As we have stated above, the Dorylinae seem to represent a line arising from a pre-ponerine stock. This is supported by the evidence of the thorax as treated by Tulloch (1935, pp. 101–103, 108, 109–111, pls. 9, 10), although Tulloch concludes differently. Reid (1941, p. 422) states, "The thorax of the Cerapachyinae is of a uniform type and seems to have affinities with the thorax of certain of the tribes of the Ponerinae. The condition of the worker thorax does not support the view that this subfamily is intermediate between the Ponerinae and the Dorylinae, for the thorax of *Dorylus* is less specialized than that of the Cerapachyinae." Reid's view corresponds very well with the evidence from the wings we have examined.

Our figures 8–11 probably correspond very well to the actual types of the reduction series leading to a wing like that of *Dorylus* (fig. 11). *Cheliomyrmex* (fig. 8) certainly looks like the most primitively veined doryline. It retains *1r* as a fairly common atavism, and *Mf1* arises far in toward the base of the wing. In *Eciton* (fig. 9) *1r* no longer occurs, and *Mf1* is beginning to fuse along *CuA* so that its posterior end is farther from the base of the wing. *Aenictus* (fig. 10) shows the loss of *Rsf2·3* and the approximation of the veins *2r* and *r-m,* a state of affairs very similar to that found in higher subfamilies (figs. 17 and 20), but with these differences: *Mf2* has not previously contracted, and *r-m* shows little inclination to change either its shape or position. The posterior end of *Mf1* is getting still closer to *cu-a,* and *Rsf1* has contracted strongly. *Dorylus* (fig. 11) has carried the contraction of *Rsf1* to completion, so that *Rs+M·Mf2* seems to take its origin directly from *R+Sc*. *Mf1* is rather close to *cu-a,* being little more than the length of the latter vein distant from it. *Dorylus fimbriatus* and some other large *Dorylus* males commonly show very inconstant adventitious veins springing from the posterior side of *Mf3*. These are possibly present due to a need for further strengthening of the wing correlated with the increased weight of the body; they may represent distorted atavisms of branches of *M* and possibly remnants of *m-cu*. One could almost derive these genera from one another in a straight line of descent such as illustrated by our sequence in figs. 8–11, but there are indications from other body characters that the internal doryline phylogeny is not quite so simple as our display of wings appears to hint.

The position of the leptanillines is debatable. They are usually treated as a subfamily by modern authors, and the venation is so highly reduced in the forms we have seen that little may be deduced from them concerning relationships to the other subfamilies.

Ponerinae, Including Cerapachyinae

Some of the paragraphs above have already treated the primitive features, as well as degenerate types, among the ponerines. We can treat the subfamily only briefly here.

The *Myrmeciini* have already been discussed in some detail. Outstanding features are the frequent presence of *1r* and traces of *Rsx,* also the position of the base of *Mf1* (fig. 3).

Amblyoponini.—These ants seem to be rather closely allied to *Myrmecia,* though not necessarily derived from the myrmeciines, as many authors have assumed. *Amblyopone* (*Stigmatomma*), including *Fulakora,* shows progressive venational reduction in its species, starting with a form very much like *Myrmecia,* except that *1r* is rarely if ever present, and proceeding to the stage where

Rsf2·3 drops out completely. *Amblyopone* (*Amblyopone*) has already been discussed in part above. The "normal" condition in this subgenus includes the complete absence of *Rsf2·3,* but several freak specimens of various species, of which Mr. John Clark has very kindly sent me camera lucida sketches, show various distorted remnants of *Rs* free abscissae *2* and *3,* and *1r.* Some of these specimens show that, with the contraction of *Mf2,* the part of *Rs* in question becomes detached basally from its former connection to the apex of *Rs+M.* The free basal end of *Rsf2* may then be attracted toward the stigma and eventually attached there. All this may happen without the loss of *1r,* resulting in a small, arcuate "bow-and-arrow" vein attached to the posterior-proximal side of the stigma. Mr. Clark's very complete series of drawings indicate very clearly how this unstable system arises and disappears, and it is to be hoped that he will publish these figures in the near future. *Mystrium* and *Myopopone* show venation much like that of *Amblyopone* (*Stigmatomma*), often with the base of *Mf1* arising distad of *cu-a.*

Other ponerines are very diverse, but many of the tribes show primitive genera or all genera to possess venation much like that of *Platythyrea* (fig. 1). As has been mentioned above, all these "higher" ponerines show a first free abscissa of *M* arising well distad of *cu-a,* except in degenerate forms where *cu-a* has been lost. In most genera, *1r* does not appear.

We consider the cerapachyines as no more deserving of subfamily rank separate from the ponerines than are other aberrant groups such as the Odontomachini. The wing venation (fig. 4) supports the implied view of Reid, cited above, that the cerapachyines are merely specialized Ponerinae. We hold this opinion even after reviewing the evidence of the male genitalia, larval structure, and ethology put forward by Wheeler and other authors.

Reid (op. cit., p. 421–422) relates the cerapachyines to the Amblyoponini and the Proceratiini on the basis of thoracic structure in the worker, and this placement is probably not too far off in our opinion. The proceratiines, represented by relict forms in many parts of the world, are highly specialized in "degenerate" direction, and due to their tendency to lead a highly hypogaeic or otherwise cryptobiotic existence show marked reduction in wing venation.

The Ectatommini show a wide range of venational patterns, with some of the more primitive forms like *Rhytidoponera* occasionally displaying *1r* as an atavism. Reduction in other genera is more marked, *Gnamptogenys* (fig. 5) being intermediate in the reduction series. Some species of *Stictoponera* show still further reduction, and some small species in which the wings are not yet known may show extreme reduction. The Proceratiini and the Ectatommini seem to be very closely related, and it is possible that they should be united into one tribe. In this group is best sought the ancestor of the Myrmicinae.

The species *Eoponera berryi* Carpenter (fig. 6), represented by a fossil wing from the Eocene of Tennessee, is peculiar in having most veins reduced in length and crowded into the center of the wing. In spite of this crowding, the elements seem to be the same and to rest in the same relative positions they hold to one another in the lower ponerines. The wing is very large in size, and Dr. Carpenter has expressed doubts to us about his placement of it in the original description (1929). Since we know of no hymenopterous group where it fits better than in the lower Ponerinae, we see no reason to dissociate it from that group. The large size of the wing is not a drawback to this placement, since it is probable that the early ant fauna was composed mostly of very large ants. We have published the figure here in the hope that some worker having a wide acquaintance with various hymenopterous wings may be able to suggest a better placement for it.

Myrmicinae and Pseudomyrminae

These two subfamilies are possibly related. In wing venation, the pseudomyrmines have remained generalized relative to the larger subfamily. Some species of *Pseudomyrma* (fig. 12), while having lost *1r*, still retain *Mf2*. In most *Pseudomyrma*, however, *Mf2* has been lost through contraction, and this is the state of affairs in the Old World forms we have examined. Most of the forms we have seen showed no further reduction, however, and probably most *Tetraponera* and *Pseudomyrma* show patterns like those of figs. 12 and 13. *Viticicola* is reduced to a pattern like that of fig. 16.

In the Myrmicinae proper, we could find no specimen with a clear-cut first radial crossvein or stub thereof, even among the genera considered primitive on other grounds than wing venation. The only genus we found at all consistently displaying an uncontracted *Mf2* was *Ephebomyrmex,* which is often considered a subgenus of *Pogonomyrmex.* In *Messor* (fig. 13) *Rsf2·3* is weakening, as is also seen in many *Aphaenogaster* species. In *Pogonomyrmex* and *Myrmica* (fig. 14) we can find the gradual stages by which *Rsf2·3* disappears, while *Veromessor* (fig. 15) and *Novomessor* often show a recurrent stub which probably corresponds to the distal end of a missing *Mf3.* A great many myrmicines have reached one of the next two alternative stages, both of which involve changes in *r-m.* These changes have been discussed earlier in this paper, and we need merely to refer the reader to figs. 16 and 17 for an understanding of the two common types. (See footnote 2 on a previous page.)

In certain genera, especially in the very small alate forms of the higher Dacetini, the veins are often reduced to the point where it is proper to say that the venation is completely blanked out. Quite often the stigma remains, however, with sometimes a small inverted T-shaped appendage projecting from it posteriorly; this appendage represents *2r* and the adjacent parts of *r-m* or *Mf3* proximally and *Rsf5* distally. *R+Sc, Rsf1, Mf1, CuA* and *M+CuA* are also quite persistent veins, often simply weakening in a gradual way until nothing but feeble furrows or disturbed lines of microtrichia mark their former presence.

Dolichoderinae and Formicinae

The Formicinae have been considered by a few authors as probably descended from a dolichoderine stem. The wing venation is clearly in agreement with this idea, so we proceed as though the formicine wing pattern were a reduction of the primitive dolichoderine type.

Fig. 18 shows a primitive living dolichoderine, *Dolichoderus attelaboides* (Fabricius), the wings of which possess all veins found in the Myrmeciini except *1r* and *Rsx.* *Dolichoderus* probably arose either from the now almost extinct Aneuretini, or from a ponerine which also gave rise to the aneuretines. We have not seen any aneuretine wings, since the only existing genus, *Aneuretus* Emery, is known with certainty only from the worker. The Aneuretini were once numerous and diverse, as is attested by the two genera Wheeler described from the Baltic Amber. Of the two genera, both with well-developed stings, *Protaneuretus,* as figured by Wheeler (1914, pp. 71–74, fig. 31), is not un-myrmicine in habitus, despite its single petiolar node. As a matter of fact, the petiole is of such a form that it could just possibly represent two petiolar nodes fused together. Someone having access to recent or fossil aneuretines could easily investigate this interesting possibility, and it is also possible that a comparative count of the postpropodeal segments in the various subfamilies would shed some light on the subject. It is perhaps better, however, to follow the conventional view that the aneuretines are directly descended from the Ponerinae. The fact that the *Protaneuretus succineus* female is scarcely larger than the worker tends to support this view.

Paraneuretus, of which Wheeler (op. cit., pp. 73–77, fig. 31) described two species, has a worker with a habitus like that of many formicines. The males of both species are known, but Wheeler unfortunately did not figure either. Wheeler says of the wings, ". . . with a discal, two complete cubital cells and a closed marginal cell, the venation closely resembling that of *Iridomyrmex*." Since the *Iridomyrmex* wing venation differs from species to species, we cannot very well say whether or not *Paraneuretus* possesses important features like *Mf2*. One needs only to consult figs. 1, 10, 13, 18, 19, 20 and 21 to appreciate the fact that a mere statement that the "first discoidal" cell is present and closed is apt to conceal the very interesting and taxonomically valuable condition of the venation which bounds and thus forms the cell.

It seems possible that *Iridomyrmex* and the other dolichoderines with thin collapsible integument, plus also the formicines, arose from something pretty much like *Paraneuretus.* While the genera *Dolichoderus* and *Hypoclinea* (figs. 18, 19) are rather conservative in venation, with usually the partial or total contraction of *Mf2* and sometimes the alignment of *2r* with *r-m* as the only signs of advancement, some other dolichoderines of higher groups display considerable reduction.

The most primitive of the formicines known both from the amber and as existing species show a well-advanced reduction of venation. In such genera as *Myrmoteras,* the wing has reached a stage of reduction similar to that of *Daceton* (fig. 17) and *Rs+M* is contracting markedly. In *Opisthopsis* (fig. 20) the contraction of *Rs+M* is completed, setting the stage for a reduction which seems to be restricted to the Formicinae: instead of *m-cu* disappearing to open the "discoidal" cell, it appears that *Mf1* drops out. We assume this to be true because of certain recurrent spurs or nodes often seen in formicine genera like *Phasmomyrmex* (fig. 21) *Pseudolasius,* etc. Also, the distance to the small crossvein *cu-a* is increased in such a way as to suggest that the "basal vein" of older authors now has a different composition than it did primitively. Posteriorly the new vein is made up of *m-cu,* which now meets *Rsf1* as though to fuse with it into an *"Rs+m-cu,"* but since *Rs+M* and free abscissae *2, 3* and *4* of *Rs* have earlier disappeared in various ways, the two veins of the false "basalis" now join to meet the proximal end of *Mf3.* In the great majority of the formicines which have lost the "discoidal" cell, there is no recurrent stub to show that *Mf1* has been lost, but nevertheless, we believe that this is the way such genera as *Camponotus* arrived at their present venation. The formicine type of venation, as was remarked upon earlier, seems to be quite stable with or without the "discoidal" cell, so that there is little further reduction of much taxonomic value in most groups.

In the foregoing paragraphs we have tried to give an idea of some major tendencies in the development of the venation of the ant forewing. Much remains to be done in the way of verification and amplification of our ideas on the subject. A study of the hindwing is badly needed in conjunction with a more detailed study of the forewing, and the findings should be applied to correct the systems within the subfamilies which Emery and others have founded upon the cells. We cannot here enter upon such protracted study as is called for. The study appears excellently suited as the subject for a postgraduate thesis, provided, of course, that sufficient representative material is available to the student.

A survey of the venation of the subfamilies of the Tiphiidae *sensu* Pate (1947) convinces us that the nomenclature suggested by us for *Anthobosca* in figure 2 will prove easily traceable through most if not all the genera of that family, and workers in various other groups of aculeates may also find the particular patterns which concern them easily reducible from the anthoboscan type.

EXPLANATION OF SYMBOLS USED IN TEXT AND PLATES

Longitudinal veins

R+Sc	Radius + Subcosta
Rsf1, Rsf2, etc.	Radial sector; first, second, etc., free abscissae
Rs+M	Radial sector fusion with median
M+CuA	Median fusion with anterior cubital
Mf1, Mf2, etc.	Median; first, second, etc., free abscissae
CuA	Anterior cubital
CuP	Posterior cubital (present as a fold)
A	Anal (first anal)
St	Stigma
x	Irregular ("adventitious") veins

Crossveins

1r, 2r	First, second radials
r-m	Radio-medial
m-cu	Medio-cubital (first)
cu-a	Cubito-anal

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EXPLANATION OF FIGURES

PLATE VIII

Forewings

Fig. 1.—*Platythyrea punctata* (Fred. Smith), female. Ponerinae: Platythyreini.

Fig. 2.—*Anthobosca chilensis* Guérin, female. Tiphiidae: Anthoboscinae.

Fig. 3.—*Myrmecia* sp., male. Ponerinae: Myrmeciini.

Fig. 4.—*Cerapachys manni* Crawley, male. Ponerinae: Cerapachyini.

Fig. 5.—*Gnamptogenys mordax* Fred. Smith, female. Ponerinae: Ectatommini.

Fig. 6.—*Eoponera berryi* Carpenter (Eocene fossil), sex and tribe uncertain. (Adapted from Carpenter 1929.)

Fig. 7.—*Plumarius hirticornis* (Ern. André), male. Plumariidae.

Fig. 8.—*Cheliomyrmex nortoni* Mayr, male. Dorylinae: Ecitini.

Fig. 9.—*Eciton* (*Labidus*) *coecum* (Latr.), male. Dorylinae: Ecitini. (After M. R. Smith 1944.)

Fig. 10.—*Aenictus pachycerus* Fred. Smith, male. Dorylinae: Ecitini.

Fig. 11.—*Dorylus* (*Rhogmus*) *fimbriatus* Schuckard, male. Dorylinae: Dorylini.

PLATE IX

Forewings

Fig. 12.—*Pseudomyrma lyncea* (Spinola), female. Pseudomyrminae.
Fig. 13.—*Messor barbarus* Linnaeus, female. Myrmicinae: Pheidolini.
Fig. 14.—*Myrmica punctiventris* Roger, male. Myrmicinae: Myrmicini.
Fig. 15.—*Veromessor pergandei* Ern. André, male. Myrmicinae: Pheidolini.
Fig. 16.—*Octostruma* sp., female. Myrmicinae: Basicerotini.
Fig. 17.—*Daceton armigerum* (Latr.), female. Myrmicinae: Dacetini.
Fig. 18.—*Dolichoderus attelaboides* (Fabr.), female. Dolichoderinae: Dolichoderini.
Fig. 19.—*Hypoclinea mariae* (Forel), female. Dolichoderinae: Dolichoderini.
Fig. 20.—*Opisthopsis haddoni* Emery, female. Formicinae: Camponotini.
Fig. 21.—*Phasmomyrmex* (*Myrmorhachis*) *polyrhachoides* Emery, female. Formicinae: Camponotini.

Hindwings

Fig. 22.—*Anthobosca chilensis* Guérin, female.
Fig. 23.—*Platythyrea punctata* (Fred. Smith), female.

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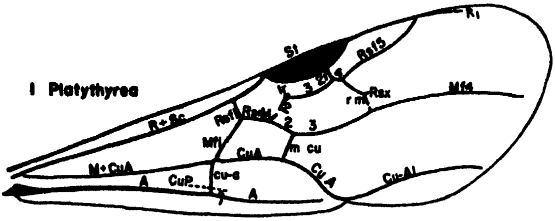
1 Platythyrea



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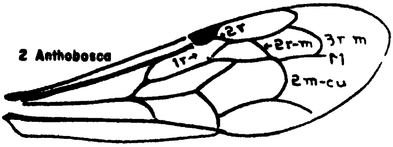

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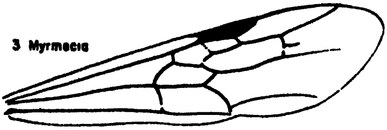

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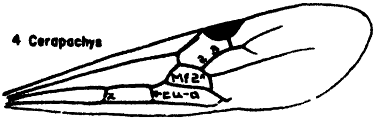

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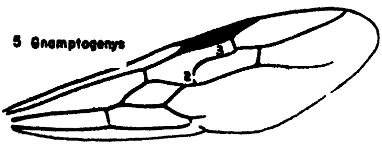

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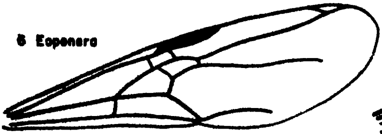

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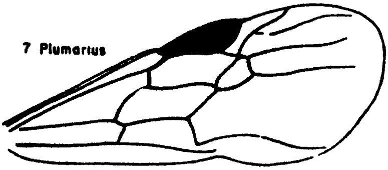

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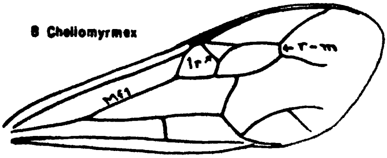

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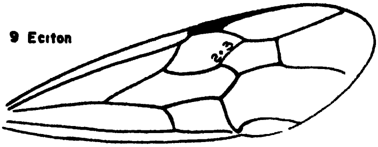

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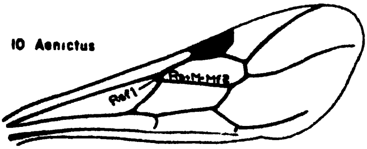

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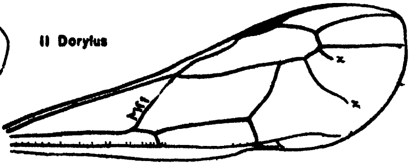

BROWN AND NUTTING—WING VENATION

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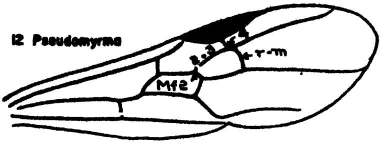

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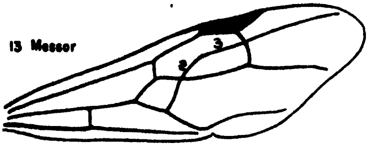

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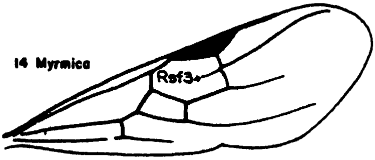

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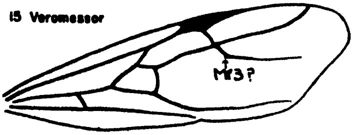

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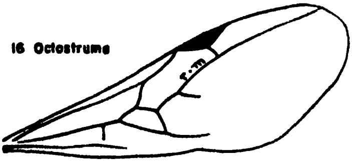

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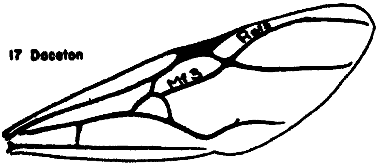

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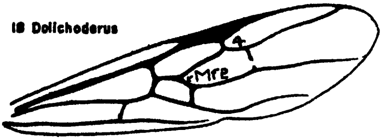

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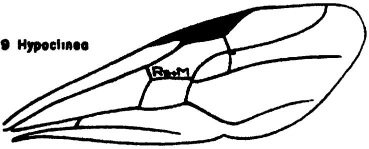

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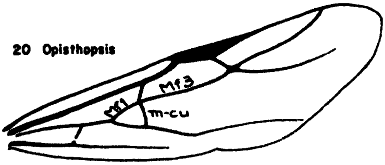

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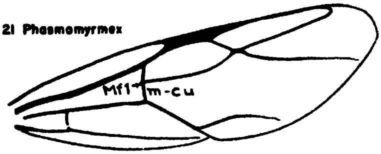

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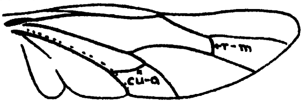

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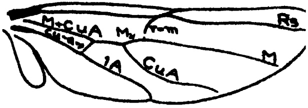

BROWN AND NUTTING—WING VENATION

A TAXONOMIC STUDY OF THE NEARCTIC SPIDER WASPS BELONGING TO THE TRIBE POMPILINI (HYMENOPTERA: POMPILIDAE).

PART I

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Kansas State College, Manhattan, Kansas

(Plates X to XVI)

INTRODUCTION AND ACKNOWLEDGMENTS

The wasps which constitute the tribe Pompilini of the family Pompilidae have long been poorly understood and notoriously difficult to identify. This is partly the result of a great deal of uncritical analysis of the group with no attempt at a critical synthesis. But perhaps part of the blame may be laid to Nature itself, for in few groups of wasps do the genera and species seem so difficult of definition, and the insects themselves so variable intraspecifically. Furthermore, we have only one set of criteria on which to base a classification of the group: the external anatomy of the adult. The internal anatomy of the adult, and the total anatomy of the egg, larva, and pupa, remain almost wholly uninvestigated, and of the life histories and behavior-patterns of these wasps we have only a smattering of information.

Members of the tribe Pompilini are common elements in the fauna of all of North America except the extreme Arctic, and are constantly being met with by field and museum workers. For this reason it has seemed desirable to attempt at this time to bring together all possible information on the morphology and biology of these wasps, and to construct a classification, well supplied with keys, illustrations, descriptions, and distributional data, which may serve as a basis for future studies of this most interesting group of insects. Because of the magnitude of this task, this revisionary study will be presented in three parts, of which this is the first. Included in this section are the introductory material, a definition of the tribe and a key to the Nearctic genera, and a systematic treatment of the first eight genera. Part II will cover the single large genus *Anoplius,* and part III will include the remaining four genera, certain conclusions regarding the phylogeny and distribution of the Nearctic forms, a check list of genera and species, and an index to the entire work.

The greater part of this study was undertaken in the Department of Entomology at Cornell University, Ithaca, New York, under the guidance of Professors J. C. Bradley and V. S. L. Pate, who first suggested the study and who have advised and encouraged me constantly to its completion. Only a few of the many other entomologists who have helped me in a great many different ways can be mentioned here. Professor Nathan Banks, of Holliston, Mass., Dr. George Arnold, of Bulawayo, Southern Rhodesia, and Dr. J. Wilcke, of Wageningen, Netherlands, have sent me copies of their valuable papers on the Pompilidae; Dr. Wilcke and Dr. P. M. F. Verhoeff, of den Dolder, Netherlands, have sent me specimens of certain species from the Palaearctic fauna which I especially needed; Dr. Kjell Ander, of the University of Lund, Lund, Sweden, has compared certain specimens for me with types at that institution; Dr. B. J. Kaston, of the Teachers College of Connecticut, New Britain, Connecticut, has determined many spiders for me. To these and to the many other entomologists who have co-operated with me, I express my sincerest gratitude.

Some 17,000 specimens have been studied in the preparation of this work. The great majority of these are in the collections of various museums and private individuals. The following list indicates the sources of this material and the abbreviations used in the text in referring to each. It is also intended as an acknowledgement of the co-operation of these individuals and institutions in providing material for these studies.

Academy of Natural Sciences of Philadelphia, Pa. [ANSP]; American Museum of Natural History, New York, N. Y. [AMNH]; University of Alberta, Edmonton, Alta. [Alta.]; California Academy of Sciences, San Francisco, Calif. [CAS]; California Insect Survey, Berkeley, Calif. [CIS]; Canadian National Collections, Ottawa, Ontario [CNC]; Carnegie Museum, Pittsburgh, Pa. [CM]; Cornell University, Ithaca, N. Y. [CU]; Emory University, Atlanta, Georgia [EU]; Howard E. Evans, East Hartford, Conn. [HEE]; James E. Gillaspy, Taylor, Texas [JEG]; Kansas State College, Manhattan, Kansas [KSC]; Karl V. Krombein, Arlington, Va. [KVK]; University of Massachusetts, Amherst, Mass. [Mass.]; University of Minnesota, St. Paul, Minn. [Minn.]; Morton S. Vogel, Washington, D. C. [MSV]; Museum of Comparative Zoology, Cambridge, Mass. [MCZ]; Oregon State College, Corvallis, Oregon [OSC]; Pennsylvania State College, State College, Pa. [PSC]; Quebec Provincial Museum, Quebec, Quebec [QPM]; R. W. Strandtmann, Lubbock, Texas [RWS]; South Dakota State College, Brookings, South Dakota [SDS]; Utah Agricultural College, Logan, Utah [UAC]; University of Kansas, Lawrence, Kansas [UK]; and United States National Museum, Washington, D. C. [USNM].

HISTORICAL RESUMÉ

Up to the year 1865 a few miscellaneous North American Pompilidae had been described by Linnaeus, Fabricius, Say, Smith, and a few others. In that year appeared the first of several papers by E. T. Cresson, in which he greatly increased our knowledge of these wasps. Of particular note is Cresson's "Notes on the Pompilidae of North America," which was the first attempt at an organized treatment of the members of the family on this continent.[1] Although without keys, it is a most valuable descriptive work and a necessary source of reference for all subsequent workers.

Up until the turn of the century, the classification of the family was simplicity itself. In Dalla Torre's "Catalogus Hymenopterorum" (1897) all the species of the world were placed in thirteen genera, and practically all the Pompilini in the genus *Pompilus*. In 1900 an era of splitting was ushered in by the publication of Dr. W. H. Ashmead's "Classification of the fossorial, predaceous, and parasitic wasps, or the superfamily Vespoidea: Family XXVII—Pompilidae."[2] The work consisted entirely of a long, and in large part unworkable, key to the genera, many of which were newly described. Fortunately he designated genotypes, and many of his genera hold today through a knowledge of the genotypes. But only recently have we begun to recover fully from the confusion created by Ashmead's "Classification."

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[1] Cresson, E. T., 1867, Trans. Amer. Ent. Soc., 1: 85-150.

[2] Ashmead, W. H., 1900-1902, Canad. Ent., 32: 149-155, 185-188, and 295-296, and 34: 79-88 and 131-137.

In 1910 appeared the first of a long series of papers by Nathan Banks on the Pompilidae (or, as he renamed them, the Psammocharidae) of North America and many other parts of the globe. His 1911 paper, "Psammocharidae: classification and descriptions," established a far sounder classification of the family, with workable keys.[3] In subsequent papers he has described many new genera and species, and elaborated upon and modified his ideas about the family. Perhaps at times he has been prone to describe genera on the basis of very insignificant characters, and to describe, as species, forms which are only variants of others; his classification is, furthermore, based almost exclusively on the females. Nevertheless, Professor Banks' contributions to our knowledge of the Nearctic Pompilidae have been very great, and his tireless research on these wasps deserves the respect of all modern students of the family.

Within the past few decades several European workers have made very important contributions to the taxonomy of the Pompilidae. It is not possible to review these here, but mention must surely be made of Haupt's monumental "Monographie der Psammocharidae Mittel-, Nord-, and Osteuropas."[4] This remarkably careful study of the European Pompilidae has been a constant source-book throughout the preparation of the present work, for the faunas of Europe and North America are closely related. Haupt has also published a number of subsequent papers of considerable value.

Two recent papers in this country have paved the way for a sounder classification of the family than has hitherto been possible. The first of these is Dr. J. C. Bradley's "Preliminary Revision of the Pompilinae of the Americas, exclusive of the tribe Pompilini."[5]

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[3] Banks, Nathan, 1911, Jour. N. Y. Ent. Soc., 19: 219-237.

[4] Haupt, H., 1927, Deutsch. Ent. Zeitschr., Beiheft. 367 pp.

[5] Bradley, J. C., 1944, Trans. Amer. Ent. Soc., 70: 23-157.

In this paper the American forms were subjected for the first time to a thorough and modern analysis. In many ways the present work is an attempt to supplement Dr. Bradley's revision by covering the tribe which he omitted. Secondly, Dr. V. S. L. Pate has recently published a most valuable and much-needed paper: "The Generic Names of the Spider Wasps and their Type Species."[6] With this as a basis it may be possible to achieve in the future a more correct application of generic names, and to go on from this to a better understanding of the limits of the genera, and their relationships and phylogeny.

MORPHOLOGY AND TERMINOLOGY

Throughout the present study I have attempted to use the terminology in most common use among hymenopterists. A few special terms have, however, been resorted to. For this reason a brief consideration of the terms used in describing the morphological features of a pompilid wasp is necessary at this point. For a more general discussion of external morphology, the reader is referred to Salman's paper on the morphology of *Pepsis elegans*.[7]

The *head* of a pompiline wasp is the source of many useful but often subtle characters (Fig. 1). The *mandibles* bear either one or two teeth along the inner margin, and are called respectively *unidentate* or *bidentate*. (Some authors consider the apex of the mandible a "tooth," and hence use the terms differently than I have done.) The *labrum* varies in size and shape, and in many forms is concealed, or almost so, by the clypeus. The *clypeus* also exhibits variations in size and shape which are of use taxonomically; the breadth of the clypeus divided by its length gives a figure which is frequently of use in separating species. The *eyes, ocelli, front,* and *vertex* all are sources of useful characters, and certain terms have been used to describe these features. The distance between the eyes at their point of closest convergence below, just above the clypeus, is termed the *lower interocular distance* (LID in fig. 1). The distance between the eyes at the greatest emargination of the orbits, near or slightly above the middle of the eyes, is called the *middle interocular distance* (MID). The distance between the eyes at their tops is called the *upper interocular distance* (UID). The greatest breadth of the head, including the eyes, is called the *transfacial distance* (TFD), while the height of the head, measured from the apical margin of the clypeus to the crest of the vertex, is called the *facial distance* (FD). The distance of the posterior ocelli from one another is called the *postocellar line* (POL), while the distance of one posterior ocellus from the nearest point on the compound eye is called the *ocello-ocular line* (OOL). By the use of these terms the features of the head may be described with some accuracy; in the females it is sometimes necessary to rely upon the proportions between these various distances for species determination.[8]

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[6] Pate, V. S. L., 1946, Trans. Amer. Ent. Soc., 72: 65-137.

[7] Salman, K. A., 1929, Trans Amer. Ent. Soc., 55: 119-153.

The *antennae* of Pompilini are not highly modified; the relative lengths of the various segments are sometimes of use in separating species. The length of the third antennal segment as compared with that of the upper interocular distance is sometimes a useful character. This is particularly difficult to judge, and one must rely upon accurate measurements. The space between the base of the mandibles and the bottoms of the eyes is called the *malar space;* the lateral portions of the head behind the eyes are called the *temples.*

The *thorax* is relatively uniform in structure throughout the tribe, but such differences as do occur are often of much taxonomic significance. The *pronotum* consists of three parts: a small anterior projection into the foramen magnum, called the *neck*, a transverse, slightly elevated piece behind this, the *collar,* and the main portion of the pronotum posterior to this, separated from the collar by an impressed line, the *streptaulus*. The ventral portion of the prothorax is directed forward, facing the temples;

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[8] Measurements of these and all other features of the morphology, where such are required, should be made with great care, using an ocular micrometer; judgment alone will often result in erroneous decisions. Since relative and not absolute measurements are important, it is convenient to have by one's side a slide rule. By reading the figures directly onto the slide rule, one may arrive at relative lengths very quickly. For example, if the upper interocular distance measures 22 and the lower interocular distance 29, one may calculate easily that UID is .76 × LID, an accurate expression of the degree of convergence of the eyes above. Such characters as these are used frequently in the keys. With a little skill in the use of a micrometer and a slide rule, nothing is lost in the way of speed in the use of the keys, and a great deal is gained in precision.

this is composed chiefly of the *propleura,* since the *prosternum* is reduced to a minute sclerite between the bases of the front coxae. The dorsal portion of the mesothorax is composed of the large *mesonotum* and behind it the *scutellum,* the latter consisting of a flat or convex .median *disc,* and the declivous *side-pieces.* The *mesopleura* are large and are continued underneath to meet on the median line ventrally; this ventral part is here called the *mesosternum,* although it is not separated by a suture from the pleura, and morphologically is undoubtedly a continuation of the pleura, the true sternum being lost. The *metanotum* is a transverse, elevated piece, followed by a depressed, very short sclerite, the *metapostnotum,* or *postnotum.* The metanotum terminates laterally at the bases of the hind wings, but the postnotum is continuous with the *metapleura.*

The *propodeum* is not strictly part of the thorax, but is best discussed here because of its close association with the metathorax. The propodeum is slightly to strongly convex in profile; posteriorly there may be a steepened portion which is nearly flat or even a bit concave, which is called the *declivity.* The laminate rim along the posterior margin of the propodeum is called simply the *posterior rim.*

The *legs* are long and vary from extremely spiny to almost spineless. In many females the front tarsus bears a series of articulated spines used in digging in the earth, called a *tarsal comb.* This varies greatly in development and is a source of generic and specific characters; unfortunately the spines are subject to wear, so that their length cannot be depended upon absolutely to represent the true length. As Banks has pointed out, the way to recognize whether a tarsal comb is present or absent is to examine the second tarsal segment: if there is a spine at the middle of this segment about as long as that at the apex, the tarsal comb is said to be present. (In Fig. 9 the tarsal comb is absent; in Fig. 3 it is present.) The *claws* are slender and bear a single tooth on the inner margin; this tooth may be short and erect, in which case the claws are said to be *dentate,* or it may be longer and sloping outward, parallel to the main shaft of the claw, in which case the claws are said to be *bifid.* The pulvillus is covered by a small pad, the *pulvillar pad,* from which arise a variable number of small setulae which constitute the *pulvillar comb*. There are often useful taxonomic characters in the pulvillar pad and comb.

The *wings* are well developed in all the Nearctic Pompilini. In the naming of the veins and cells of the wing I have used the system in common use among aculeate hymenopterists, the Jurine-Cresson system, and it seems unnecessary to describe this in detail. The uninitiated will find a figure in Matheson's "Entomology for Introductory Courses," p. 448, illustrating this system of wing venation. In most Pompilidae the anal and transverse median veins of the hind wing are completely confluent, and the entire vein in this case is merely called the *anal vein*.

The *abdomen* of the *female* is composed of six evident segments, each consisting of a tergite and a sternite. The tergites are called tergite 1, tergite 2, . . . tergite 6, proceeding from front to rear, and the sternites similarly sternite 1, sternite 2, . . . sternite 6. The apical tergite, tergite 6, is also called the *pygidium;* there is no distinct pygidial area set off on this tergite as in many aculeates, but the whole tergite is so called. Similarly the apical sternite may be called the *hypopygium*. It should be remembered, of course, that morphologically tergite 1 is that of the second true abdominal segment, but to call it the second in the text would lead to confusion and be contrary to the usual practice among hymenopterists.

The *abdomen* of the *male* is composed of seven visible segments. The tergites cause no difficulty and are numbered simply tergite 1 through 7. The first six sternites are similarly numbered sternite 1 through 6. Sternite 6 always possesses a median emargination along its posterior margin, on each side of which is a small chitinized process, somewhat hook-shaped. The seventh sternite is modified to form a somewhat tongue-shaped flap which closes the genital orifice, and is called the *subgenital plate*. This represents the true ninth sternite, true sternite eight being entirely internal and forming a usually V-shaped sclerite at the base of the subgenital plate; in the text this is called the *basal sclerite* .of the subgenital plate.

The *male genitalia* (Fig. 2) are much used for separating species, and to a limited extent in defining genera. In the naming of the parts of the genitalia, I have in general followed Snodgrass'

"The Male Genitalia of Hymenoptera",[9] although a number of structures were not named by Snodgrass, and in these cases the terms of certain other authors have been employed. At the extreme base is a short, hollow cylinder called the *cardo* or basal ring (*co* in Fig. 2). In the phallus itself the central structure is the *aedoeagus* (*ae*), an elongate, lightly sclerotized structure with two basal apodemes (*ap*) which attach it to the phallobase. On each side of the aedoeagus and quite closely supporting it are the *parapenial lobes* (*pl*), which arise from a broad base on the dorsal side of the genitalia and are usually quite slender and elongate; these never bear setae of any kind. The next structures are those of the *volsella*; these are chiefly ventral and consist of a *basal plate* or *basis volsellaris* (*ba*), which may bear one or several setae, and distad of this a more or less elongate appendage, the *digitus* or *digitus volsellaris* (*di*), which is the source of many excellent specific characters because of differences in shape and the nature of the setae it bears. In addition there are structures lying between the basal plates which in shape suggest a bird's-head; these are called the *basal hooklets* (*bh*). These have never been noted with more than passing interest by previous workers, but actually are of considerable generic value. Where they consist of a single sclerotized point (as in Fig. 2) they are said to be *single*; in some genera there is a second pointed process below this, and in such case they are said to be *double* (as in Fig. 42); they are sometimes wanting altogether. The outermost appendages of the genitalia are the *parameres* (*pr*), which are generally elongate and more or less setose; near the base, or part way out on the ventral side, there may be a slightly elevated and more heavily pigmented area for which it is convenient to have a name, and for which the term *squama* is used (*sq*). Illustrations of the male genitalia of most of the Nearctic Pompilini are included in this work. In all these figures, the ventral view is shown on the left side, the dorsal on the right.

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[9] Snodgrass, R. E., 1941, Smithsonian Misc Coll., vol. 99, no 14

BIOLOGY

The Pompilini are relatively generalized Pompilidae in behavior as well as in structure. Nevertheless there is considerable diversity in habits within the tribe, so much so that the taxonomist is able to learn much about the relationships of the various genera and species from a study of their biology. Instinctive behavior patterns are inherited just as strictly as morphological features, and there can be no doubt of their genetic basis, or that biological criteria are any less important than morphological criteria in the study of the relationships of wasps. Unfortunately our knowledge of the life histories and behavior patterns of the Pompilini consists in general of little more than fragments, for only a very few workers have had the infinite patience required to study these interesting wasps in the field.

Under the various genera and species on the pages which follow, I have attempted to describe briefly whatever is known of their biology, and to indicate the sources of this knowledge. At this point it may be well to outline briefly the behavior of a "typical" pompiline wasp, in order that the variations on this theme exhibited by the different genera and species may become more apparent. Only the behavior of the adult female is noteworthy; that of the male consists merely of the fertilization of the female, and that of the larva consists merely of devouring the spider placed before it by the female parent.

There are four phases in the behavior of the pompiline wasp associated with the laying of a single egg; since normally a considerable number of eggs are laid by a female, these are repeated a number of times in the life of the wasp. (1) *The Search.* The wasp, usually walking over the ground or foliage with the wings vibrating and the antennae in constant motion, combined with short flights, undertakes a more or less random search for a suitable spider in an appropriate habitat. Some Pompilini appear to take any spider of sufficient size which presents itself, while others attack only spiders of a certain family or genus, rarely a single species of spider. (2) *Paralysis.* Once a desired spider is found, both wasp and spider exhibit a high degree of nervousness, the spider apparently showing fear and attempting to escape, the wasp pursuing it in a frenzy until it is able to sting it. The sting is normally inflicted on the ventral side of the cephalothorax, but is not always so precisely placed as earlier entomologists believed; frequently the spider is stung several times. Paralysis is immediate, but the duration of paralysis very variable. (3) *Transportation.* The best hunting-grounds for spiders are not often the best nesting-sites for fossorial wasps; the wasp therefore usually finds it necessary to transport its prey some distance. The common method among the Pompilini is for the wasp to walk backward, carrying or dragging the spider, which it holds in its mandibles by the base of the posterior legs. During transport frequent stops are made for exploratory purposes. A few species fly with their prey. (4) *Nidification.* The majority of Pompilini are fossorial, that is, they construct their nests by digging in sand or loose earth. By means of the tarsal comb, the other spines on the legs, and sometimes the mandibles, the wasp constructs a gallery in the earth with an enlarged terminal cell. In this cell the spider is placed and an egg laid upon it, usually ventrally on the abdomen; the tunnel is then refilled with earth. The nature of the soil in which a pompilid is accustomed to nest often determines its habitat. Many species are rather strict psammophiles, rarely being taken far from sandy places; others choose soft, loamy earth; still others in gravel or among rocks. Some forms show a preference for ledges, stone walls, and niches in buildings; still others use beetle galleries or other niches in wood. Such species as have lost the fossorial habit have also lost the tarsal comb. So far as known, all Nearctic Pompilini construct a separate nest for each spider captured, though some exotic species are reputed to build multicellular nests in the earth.

The many variations on this fundamental pattern of behavior cannot be reviewed here, but will become apparent in the pages which follow. The most striking thing will be, however, the incompleteness of our knowledge of the habits of even some of our commonest spider wasps. Of several genera of taxonomic importance, nothing whatever is known. The patient field observer may yet learn a wealth of facts about these wasps, and his efforts will be rewarded not only by the thanks of taxonomists and students of animal behavior, but by his acquaintance with the wasps themselves, for few insects are so fascinating in their activities as these intrepid hunters of spiders.

TAXONOMY

There exists little agreement among students of the Pompilidae, past and present, as to the broader aspects of the classification of the family. Banks, in his 1911 classification,[10] divided the family into four subfamilies, the Pepsinae, Psammocharinae, Ceropalinae, and Notocyphinae. Haupt[11] later increased the number of subfamilies to eight, adding the Macromerinae, Claveliinae, Homonotinae, and Pedinaspinae. If we include the Cryptocheilinae and Aporinae, which also have sometimes been ranked as subfamilies, we have a maximum of ten. Undoubtedly the number of subfamilies recognized by future workers will be much fewer than this. As yet no single student, with sufficient material from all parts of the globe before him, has set himself to the task of critically reconsidering the classification of the family. Pending such a study, a conservative point of view seems desirable.

In any event, there has been general agreement among authors as to the validity of the Pompilinae (or Psammocharinae) as a discrete subfamily, and as to its approximate limits. Haupt, it is true, divides it into three subfamilies, the Psammocharinae, Pedinaspinae, and Homonotinae; however, he groups these together in what he calls the Psammochäridae trachyscelides, as opposed to the remainder of the family, which he calls the Psammocharidae lissoscelides. Arnold[12] has pointed out the impossibility of dividing this part of the family into more than a single clearly defined subfamily. This subfamily seems to represent a single broad phyletic line, and its characters are described briefly below.

Bradley[13] has recently placed the trachyscelid genus *Psorthaspis* in the Ctenoceratini, a group which Haupt and Arnold consider to belong to the lissoscelides. Although it is true that the females of *Psorthaspis* show remarkable resemblances to those of *Ctenocerus*, *Dromopompilus*, and certain other Ctenoceratini, particularly with regard to the shape of the head and prothorax, in certain other perhaps more fundamental characters, such as the nature of the spines at the apex of the hind tibiae, the spine-pits on the femora, and the male genitalia, the difference is great. It seems likely to me that these resemblances, however striking, may be due to convergence, these genera probably all being predators on subterranean spiders. That *Psorthaspis* and the Ctenoceratini might belong to entirely different stocks has already been suggested by Arlé.[14] While the matter cannot be considered closed, I prefer to place the tribe Ctenoceratini in the Pepsinae, and the American genus *Psorthaspis* in the Pompilinae, tentatively in the tribe Aporini.

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[10] Banks, Nathan, 1911, Jour. N. Y. Ent. Soc., 19: 219-237.

[11] Haupt, H., 1929, Mitt. Zool. Mus. Berlin, 15: 108-197.

[12] Arnold, George, 1935, Ann. Transvaal Mus., 15: 413-416.

[13] Bradley, J. C, 1944, Trans. Amer. Ent. Soc., 70: 30-36.

The division of the subfamily Pompilinae into tribes is not an easy matter, particularly in the light of our limited knowledge of certain faunas. Arnold,[15] after stating reasons for abandoning Haupt's division of the group into three subfamilies, divided the Ethiopian Pompilinae (Psammocharinae) into ten tribes. Working on the American fauna, Bradley [16] a few years later divided the subfamily into seven tribes. The only tribe these two classifications have in common is the Pompilini (Psammocharini)! Clearly if one were to extend these classifications into still other faunal regions, the result would be a prodigious number of tribes, separated often on very tenuous characters, and many of them monogeneric. A diametrically opposite point of view is presented by Banks,[17] who doubts if the subfamily can be divided into tribes at all.

I expect these points of view will eventually be reconciled, and the Pompilinae of the world divided into several tribes, representing natural phyletic lines; this must, however, await a general reclassification of the family, as noted above. In the meantime, I prefer to recognize two tribes among the Nearctic Pompilinae: (1) those genera specialized in the structure of the head and prothorax for entering the tunnels of subterranean spiders, i.e., Bradley's tribe Aporini, plus the genus *Psorthaspis,* and (2) those genera not specialized in this manner, i.e., Bradley's tribes

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[14] Arlé, Roger, 1947, Revista de Entomologia, 18: 418.

[15] Arnold, George, 1937, Ann. Transvaal Mus., 19: 75-81.

[16] Bradley, J. C., 1944, Trans. Amer. Ent. Soc., 70: 28-30.

[17] Banks, Nathan, 1947, Bull. Mus. Comp. Zool., 99: 371–372.

Pompilini, Allocyphonychini, and Allocharini. Admittedly (1) is derived from (2), probably polyphyletically; nevertheless, this arrangement seems to me to express most clearly the relationships of the Nearctic genera, at least in the light of our present knowledge of the world fauna.

Following a short analysis of the characters of the subfamily Pompilinae, I have presented a key which will separate the two tribes in the Nearctic fauna. This is followed by a summary of the characters of the tribe Pompilini and a key to the Nearctic genera; subsequent pages treat these genera and their contained species and subspecies.

Summary of Characters of the Subfamily Pompilinae

Apex of hind tibia with a number of spines which are of unequal length, irregularly spaced, and more or less radiating. Hind femur usually with several small spines or spine-pits on the upper surface near the appex. Hind tibiae never serrate. Second abdominal sternite without a transverse groove. Subdiscoidal vein of the fore wing usually deflected downward at its base, forming a small pocket at the lower inner corner of the third discoidal cell.

Key to Tribes of Nearctic Pompilinae

Pronotum very long, usually longer than the mesonotum, its posterior margin nearly transverse, sometimes with a slight median notch; pronotal collar of female not much if any depressed, in almost the same plane as the vertex and the thoracic dorsum as seen in lateral view; propodeum never produced postero-laterally into pointed processes; either with two submarginal cells in the fore wing, or if with three, the scape of the female is compressed and the front grooved to receive it, and in the male the propodeum is excavated behind, the sides of the concavity projecting backward as short, vertical ridges, and the parameres of the genitalia are very short, truncate apically; antennae of males short, the third segment always less than twice as long as thick ....APORINI

Pronotum rarely slightly longer than the mesonotum, usually distinctly shorter, its posterior margin angulate, arcuate, or sometimes nearly straight; pronotal collar in the female always depressed, on a much lower plane than the vertex or the thoracic dorsum; fore wing with three submarginal cells, or if with two, the propodeum is produced postero-laterally into sharp, conical processes; scape rarely slightly compressed, the front without distinct antennal scrobes; propodeum of variable shape, but never with the postero-lateral angles produced backward as vertical ridges; antennae of males variable ....POMPILINI

Tribe POMPILINI Fox

Pompilini Fox, 1894, Proc. Acad. Nat. Sci. Phila., 1894, p. 296. [Described as a tribe, but having the rank of a subfamily] [In part.]—Bradley, 1944, Trans. Amer. Ent. Soc., 70: 28-30. [Plus the tribes Allocharini (p. 147) and Allocyphonychini (p. 105).]

Anopliini Ashmead, 1902, Canad. Ent., 34: 80. [Tribe of subfamily Aporinae.] [In part.]

Psammocharinae Haupt, 1927, Deutsch. Ent. Zeitschr., Beiheft, p. 24. [Subfamily, but with about the same limits as the tribe Pompilini as here defined.]

Psammocharini Dreisbach, 1949, Ent. Amer., 29 (n. s.): 1-58.

The tribe Pompilini consists, in brief, of a number of genera centering around the genus *Pompilus*, either quite generalized or representing a low degree of specialization. The single most characteristic feature of these wasps is the tarsal comb of the female, but this is not possessed by all of the members of the tribe.

Tribal characters.—Small to fairly large wasps (3-30 mm.) of variable color, but the dominant color black; wings hyaline to fuscous, only rarely yellowish. Body clothed wholly with a close, fine pubescence, which may be blackish, brownish, cinereous, silvery, or more or less refulgent of dark metallic colors. Body usually with a certain amount of erect hair, sometimes very densely hairy, or, at the other extreme, practically devoid of hair.

Head inserted rather high on the prothorax, the eyes prominent, bare or with only minute, scarcely evident setulae Palpi slender, simple. Each mandible with a groove below, which terminates some distance from the apex, and from which arise several bristles (except in *Allochares*). Clypeus a transverse sclerite about as wide as the lower front, or a little more or less, usually somewhat convex, never elevated and plate-like. Antennal bases somewhat removed from the margin of the clypeus. Front not or scarcely grooved or depressed to receive the antennae; scape somewhat barrel-shaped, not compressed (slightly compressed in *Chalcochares*). Vertex rounded, never acute, always on a higher plane than that of the pronotal collar.

Pronotum not especially long, its median dorsal length rarely greater than that of the mesonotum, usually much shorter; streptaulus impressed dorsally and dorso-laterally, delimiting an anterior collar which is on a much lower plane than that of the vertex or the remainder of the pronotum; pronotum behind the collar arched upward to the level of the mesonotum, never with a vertical anterior surface perpendicular to the dorsum. Front tarsus of female with or without a tarsal comb; front femora never incrassate; apical tarsal segments with or without a median row of spines beneath, occasionally with a few lateral spines; claws dentate or bifid. Wings fully developed;

fore wing usually with three submarginal cells, but if with only two, it is the second transverse cubital vein which is lacking, never the third.

Male genitalia with the parameres normally elongate, never abruptly truncate apically. Basal hooklets present or absent. Parapenial lobes elongate, usually flattened dorsoventrally, but sometimes triangular in cross-section or rarely flattened from side to side. Aedoeagus elongate, occasionally bearing short spines along the shaft.

Biology.—The members of this tribe are primarily predators on errant or web-spinning spiders belonging to the suborder Labidognatha of the order Araneae. The prey is placed singly in a ready-made niche or more commonly in a burrow constructed in the ground and having an enlarged terminal cell. A single egg is laid upon it and the nest is covered; the larva consumes the spider and pupates in the nest.

Distribution.—Cosmopolitan. There are a number of genera not represented in the Nearctic fauna, where, according to my interpretation, there are thirteen genera.

Key to the Genera of Nearctic Pompilini

1. Propodeum not produced postero-laterally into sharp, conical processes; legs more or less spinose; postnotum a transverse band of variable width, never broadly concealed dorsally 2

Propodeum bearing sharp, conical processes postero-laterally; basal hooklets of male genitalia wanting; either (a) the legs smooth and almost devoid of spines, or (b) the postnotum concealed dorsally, the metanotum and propodeum in broad contact 12

2. Anal vein of hind wing straight, paralleling the preaxillary furrow for its entire length, the transverse median vein leaving it at an angle; cubitus of hind wing extending beyond the transverse cubital vein only as a short stub (Fig. 11); posterior rim of propodeum virtually absent, represented merely by a narrow ridge.
I. **Tastiotenia** new genus

Anal and transverse median veins of hind wing confluent and forming an arch (Figs. 10 and 13); cubitus of hind wing extending considerably beyond the transverse cubital vein; posterior rim of propodeum well developed 3

3. Anal lobe of hind wing very large, about three-fourths the length of the submedian cell (Fig. 10); spines beneath the apical tarsal segments of the female in an irregular double row; males very densely hairy, even on the abdominal dorsum ....II. **Chalcochares** Banks

Anal lobe smaller, at most a little over half the length of the submedian cell (Figs. 12 and 60); spines beneath the apical tarsal segments, when present, in a single median row (occasionally also with one or two lateral spines); males never as densely hairy, the abdominal dorsum not at all hairy 4

4. Malar space well developed, about as long as, or longer than, the antennal pedicel; labrum fully exposed; claws bifid in both sexes; antennae of male beyond the third segment subserrate; hypopygium of female strongly compressed, hirsute ....XIII. **Paracyphononyx** Gribodo

Malar space shorter than the pedicel, usually very short or practically absent; antennae of males slender, at most with very feeble serrations on the apical few segments; hypopygium of female at most moderately compressed 5

5. Anal vein of hind wing meeting the media beyond the origin of the cubitus (Figs. 59 and 60), except occasionally in *Episyron*, which has a scale-like pubescence on the first abdominal tergite; postnotum considerably arcuately broadened on each side between the median line and a point just above the spiracles, where it is constricted (Figs. 69 and 70) 6

Anal vein of hind wing meeting the media before or at the origin of the cubitus (Figs. 12 and 58), or sometimes a little beyond, in which case the postnotum is very short, transversely linear; in any case the postnotum is not as above, but with nearly parallel margins; never with scale-like pubescence 8

6. Apical tarsal segments without spines beneath; all the claws of both sexes dentate; wings very long, never folded longitudinally in repose; body without scale-like pubescence . .V. **Sericopompilus** Howard

Female: apical tarsal segments with a row of spines beneath Male· claws bifid 7

7. First abdominal tergite and more or less of the propodeum and parts of the thorax, with appressed, scale-like pubescence; claws of both sexes bifid ....VI. **Episyron** Schiødte

Without such scale-like pubescence; at least the middle and hind claws of the female dentate; eyes of female strongly converging above.
VII. **Poecilopompilus** Howard

8. Front with a distinct blunt tubercle between and slightly above the antennal orbits, present in both sexes but less pronounced in the male (Figs. 54 and 55); pronotum with a slight median impression; mostly ferruginous species ....VIII. **Tachypompilus** Ashmead

Front without such a tubercle; frontal elevation of male, if present, ill-defined and sloping gradually to the face below; Nearctic species never mostly ferruginous 9

9. Female: pygidium with numerous setae, at least a few of which are stout, brittle, and bristly, directed caudad; pulvillar comb strong, of from 12 to 26 subparallel setulae. Male: claws bifid.
IX. **Anoplius** Dufour

Female: pygidium with a few slender, flexible setae or none at all, never with bristles. Male: claws of middle and hind legs, at least, dentate ...10

10. Antennae relatively short and thick, the third segment in the female not more than 2.8 times as long as its greatest thickness, and never equal to more than six-tenths the upper interocular distance, the vertex always being very broad (Figs. 25 and 26); third segment in the male not more than twice as long as thick (Figs. 29, 30, 31, and 35); pulvillar comb of not more than seven weak setulae (Fig. 7).
III. **Evagetes** Lepeletier

Antennae more elongate, the third segment in the female at least three times as long as thick, and usually equal to more than six-tenths the upper interocular distance; third segment in the male more than twice as long as thick; if the pulvillar comb is greatly reduced (in the female) the antennae are very long and slender 11

11. Subdiscoidal vein of the fore wing reaching the wing margin or nearly so, the second recurrent vein arising more than half-way out on it (Fig. 58); pulvillar comb of not more than seven weak setulae (Fig. 36); species of delicate build and very slender appendages.
IV. **Agenioideus** Ashmead

Subdiscoidal vein not reaching the wing margin; second recurrent vein arising half-way or less of the distance from the base of the subdiscoidal vein to the wing margin (as in Fig. 12).
X. **Pompilus** Fabricius

12. Legs spinose, the female with a tarsal comb; postnotum concealed dorsally, the metanotum and propodeum in broad contact; fore wing frequently with only two submarginal cells; head not notably concave behind .. ..XI. **Aporinellus** Banks

Legs virtually devoid of spines; postnotum complete; always with three submarginal cells in the fore wing; head rather strongly concave behind and convex in front, more markedly so in the male; malar space fairly long ....XII. **Allochares** Banks

I. Genus **TASTIOTENIA** new genus [18]

GENOTYPE: *Tastiotenia festiva* new species.

This curious new genus, known at present from only two specimens, possesses a strange mixture of characteristics. The propodeum is practically without a posterior rim, suggesting *Cero-*

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[18] Named for the Tastioteño, an ancient Indian tribe of Seri stock, which formerly inhabited a portion of the west coast of Sonora, Mexico.

pales; the broad, finely punctate head, with relatively small eyes and broad temples, suggests *Priocnemis* and certain other pepsines; the unusual venation of the hind wing is approached only by the obviously unrelated *Allaporus* in our fauna, and by certain Old World forms usually placed in the Idopompilini. Yet for all this it seems to be a pompiline, albeit a very primitive one. The hind femora possess minute spines above, near the apex; the spines on the tibiae are arranged as in the Pompilinae, those at the apex being of variable length and irregularly spaced; the second abdominal tergite is without a transverse furrow; there is a slight indication of a pocket at the lower inner corner of the third discoidal cell of the fore wing. It would seem to be a relic of the stock of very early Pompilinae, before certain features of these wasps became fully fixed.

Generic characters—(Female only; male unknown) Small wasps, 5 to 6 5 mm. in length, the only known species in large part ferrugino-castaneous, marked with black and pale yellow. Body clothed with a fine, silvery pubescence, and entirely devoid of erect hairs.

Head much broader than high, the temples strongly developed, especially above, integument of head finely and evenly punctate. Palpi slender, short; apical segment of maxillary palpus about as long as the antennal pedicel. Mandible with a single tooth on the inner margin, the outer margin with a number of bristles arising from a groove, as in nearly all Pompilini. Labrum mostly concealed by the clypeus, its apical margin bristly, slightly emarginate. Clypeus very broad, its apical margin broadly truncate Malar space very short Front very broad, moderately convex, without prominences, and with only a faint median groove just above the antennal orbits. Antennae slender, of moderate length, the third segment equal to much less than half the upper interocular distance. Vertex raised slightly and in an even arc above the tops of the eyes.

Pronotum with the streptaulus complete, the collar much depressed below the level of the thoracic dorsum and of the vertex, the slope of the pronotum behind the collar gradual and even Postnotum a transverse band nearly the length of the metanotum, with a median linear impression, without striations. Propodeum short, with an oblique posterior declivity nearly as long as the anterior, horizontal part; posterior rim indicated by only a very small ridge Mesopleuron rather strongly convex across its short axis.

Legs with numerous short, dark spines, hind femora with some minute spines on the upper side near the apex; all the tibiae with a few unequal, irregularly spaced, splayed-out spines at their apices. Front tibiae without other spines except for two or three on the outer side; middle and hind tibiae sparsely spinose on the sides and above. Tarsal segments, except the last, with a sparse median ventral row of short spines. Front basitarsus with three short spines along the outer side, one at the apex, and the second segment with one at the apex; no true tarsal comb. Claws dentate; pulvillar pad small, the comb very weak.

Fore wing with the transverse median vein meeting the media basad of the basal vein. Stigma small; radial vein nearly evenly arcuate; marginal cell removed from the wing-tip by a little more than its own length; 2d and 3d submarginal cells both 4-sided. Third discoidal cell removed from the outer wing margin by slightly more than its own length, and with a very slight pocket at its lower basal corner; second recurrent vein nearly vertical, meeting the subdiscoidal vein less than half-way from its base to the outer wing margin Hind wing with the anal lobe small; anal vein straight, paralleling the preaxillary furrow, terminating at the transverse median vein, which it meets at an angle, the latter vein joining the media much before the origin of the cubitus. Cubitus terminating a very short distance beyond the transverse cubital vein. (Wings shown in Fig. 11.)

Abdomen short, rather stout, the apical segment only very slightly compressed; sting well developed.

Distribution.—Lower Sonoran fauna of the western United States and Mexico.

1. **Tastiotenia festiva** new species (Plate XI, fig. 11.)

Female.—Length 6.5 mm.; fore wing 4.2 mm. Head black, except that the clypeus is castaneous, the mandibles castaneous tipped with ferruginous, the antennae dusky-castaneous, the apical segments darker, almost black. Propleura dark brown; pronotum ferrugino-castaneous, the posterior margin with a broad stripe of pale yellow. Mesonotum, tegulae, scutellum, metanotum, postnotum, mesopleura, and mesosternum dark brown varying to black. Metapleura, propodeum, all the legs, and the entire abdomen ferrugino-castaneous. Entire body clothed with a light silvery pubescence. Wings hyaline, the apical fourth of the fore wing lightly banded with brownish.

Clypeus 3.5 times as broad as high, about as broad as the lower front. Front very broad, middle interocular distance .67 × transfacial distance. Inner orbits converging above, middle interocular distance about equal to lower interocular distance, upper interocular distance .87 × lower. Ocelli in a large triangle on a broad vertex, forming a right angle in front; postocellar line is to ocello-ocular line about as 7:6. First 4 antennal segments in a ratio of 20:8:19:18, segment 3 equal to .46 × upper interocular distance.

Posterior pronotal margin angulate. Median line of propodeum lightly impressed in front. Fore wing with the marginal cell 1.3 × its own length from the wing-tip; 2d submarginal cell nearly twice as broad as high, narrowed by about half above; 3d submarginal cell much smaller, higher than broad, as wide above as below. (Fig. 11.)

The single paratype is 5 mm. long, the fore wing 3.8 mm. The color is the same as that of the type except that the clypeus is dark brown and the anterior portion of the propodeum is suffused with blackish for a short distance. Middle interocular distance is .66 × transfacial distance; upper interocular distance is .91 × lower interocular distance; antennal segment 3 equals .42 × upper interocular distance. The 3d submarginal cell of the fore wing is a little wider than in the type, approximately square.

The type lacks the right antenna. The paratype lacks the apical four segments of the right antenna, and parts of the tarsi on all but two legs; this specimen is abnormal in that the 3d transverse cubital vein is lacking from the right fore wing.

MALE.—Unknown.

Distribution.—Known only from the Colorado Valley of southern California and the west coast of Sonora, Mexico.

Holotype.—MEXICO: Sonora: ♀, Guaymas, 29 Sept. 1923 (W. M. Mann) [USNM]. *Paratype.*—UNITED STATES: California: San Bernardino Co., ♀, Needles, 1-6 April 1918, on mesquite [CU].

II. Genus **CHALCOCHARES** Banks

Chalcochares Banks, 1917, Bull. Mus. Comp. Zool., 61: 107. [Type: *Psammochares hirsutifemur* Banks, 1914; monobasic.] [Proposed as a subgenus of *Psammochares*]—Dreisbach, 1949, Ent. Amer. (n. s) 29: 6.

Anotochares Banks, 1939, Canad. Ent., 71: 225, 228. [Type *Anotochares engleharti* Banks, 1939; monobasic.] New synonymy—Dreisbach, 1949, Ent. Amer. (n. s.) 29: 6, 7, 9.

This genus is not closely allied to the preceding, but is placed here because, like *Tastiotenia,* it possesses a number of curious and probably primitive characters. The hind wings are unusually broad and full, the anal lobe very large; the anal and transverse median veins of the hind wing are confluent, but the tip of the anal vein is usually preserved as a small stub; the abdomen has a tendency to be somewhat constricted between the basal segments; the pronotum of the female is flattened above; the pubescence is bluish or purplish, and the body unusually hairy, at least in the males. These and other characters suggest a primitive condition, and also suggest a possible relationship to such genera as *Psorthaspis* and *Aporus,* which are not usually placed in this tribe. On the other hand, there are certain resemblances to the following genus, *Evagetes.* Unfortunately nothing is known of the biology of *Chalcochares;* perhaps a knowledge of its biology will someday shed light on its true position and relationships.

Generic characters.—Medium-sized to fairly large wasps, 10 to 30 mm. in length. Color black, rendered conspicuously bluish or purplish by the pubescence. Body unusually hairy; propodeum densely, and femora to some extent hairy in both sexes; male densely hairy all over, including even the abdominal dorsum, the hair on the clypeus and lower front extremely dense.

Mandibles bidentate in both sexes. Clypeus not quite as wide as the lower front, slightly elevated, the apical margin in the male evenly rounded, in the female truncate. Labrum mostly or wholly concealed, its apical margin feebly emarginate, the apical fringe of bristles not especially long. Malar space present, shorter than the antennal pedicel. Scape of antenna rather long, in both sexes at least as long as the third antennal segment, in the female slightly compressed toward the base; length and thickness of the flagellum not differing noticeably in the two sexes. Front in the female slightly depressed below and to the sides of the antennal orbits; front in both sexes very broad, middle interocular distance at least .65 × transfacial distance. Vertex very broad, elevated slightly to very strongly above the tops of the eyes.

Pronotum rather long, its posterior margin arcuate; slope abrupt just behind the collar, the surface thereafter nearly flat, in the same plane as the mesonotum, broad, the shoulders rather prominent, especially in the female; sides of the dorsum rather sharp, at least in the female, the sides of the pronotum nearly vertical. Postnotum a very narrow transverse band, more or less overhung medially by the strongly convex metanotum. Mesopleura convex, prominent. Propodeum relatively short and broad, very abruptly declivous behind, the declivity rather sharply defined, oblique but approaching vertical; posterolateral angles prominent, humped, in the females obscurely rugulose; females with a rounded elevation just behind the spiracles, faintly indicated in the males. Legs spinose; female without a tarsal comb, but the front tarsus rather strongly spinose, the front tibia with some stout, curved spines at its apex (Fig. 9); apical tarsal segments spined beneath in the female, the spines forming two irregular rows rather than a single row; last segment of front tarsus of male unmodified; all the claws dentate in both sexes; tibial spurs rather short. Pulvillar pad small, the comb not well developed, of not over 12 setulae. Front legs of male, especially the coxae, rather disproportionately small

Hind wing unusually broad, the anal lobe large, at least three-fourths the length of the submedian cell; preaxillary excision not well defined, but located slightly beyond the end of the submedian cell. Anal vein well rounded out or somewhat angulate below its junction with the media, usually with a short stub vein at this point. Fore wing with the basal and transverse median veins interstitial on the media, or the latter slightly basad of the former. Stigma of moderate size; marginal cell about or slightly more or less than its own length from the wing-tip, the radial vein somewhat angled at the 3d tranverse cubital vein; 2d submarginal cell quadrate, 3d 4-sided but slightly to strongly narrowed above. (Wings shown in Fig. 10.)

Abdomen of the female stout, the apex hirsute but without bristles; tergite 1 with the anterior surface nearly perpendicular to the dorsal. Abdomen of the male rather stout, showing feeble constrictions between the basal segments, especially the first and second; tergite 1 with the anterior surface vertical, fitting closely to the propodeal declivity; entire abdomen densely hairy above and below. Sternite 6 with the emargination very large, U-shaped. Subgenital plate tongue-shaped, flat, compared to the other sternites weakly pilose. Genitalia (Figs. 16 and 17) with the aedoeagus slender, deeply cleft apically, more or less folded longitudinally; parapenials stout, subtriangular in cross-section, in lateral view very wide; basal hooklets single; parameres densely bristly along their lower inner margin.

Biology.—Nothing fundamental is known of the biology of members of this genus; a few habitat notes are included under each of the species.

Distribution.—Lower Sonoran fauna; Mexico and the four states of the United States bordering it. Only two species are known.

Key to Species

Females

Vertex elevated far above the tops of the eyes, in anterior view nearly straight across and with a slight median impression, ocelli far removed from the crest of the vertex; length 19-30 mm.
1. **engleharti** (Banks)

Vertex elevated slightly and in an even arc above the tops of the eyes; ocelli not unusually far from the crest of the vertex; size 12-19 mm.
2. **hirsutifemur** (Banks)

Males

Vertex extended a considerable distance above and behind the eyes (Fig. 15); parameres of genitalia very strongly curved (Fig. 16); size 14-23 mm. . . . . .1. **engleharti** (Banks)

Vertex rounded off only a little above and behind the eyes (Fig. 14); parameres in ventral view but slightly curved (Fig. 17); size 10-15 mm. . . . . .2. **hirsutifemur** (Banks)

1. **Chalcochares engleharti** (Banks) new combination [10]

(Plate X, fig 9; plate XI, figs. 15 and 16)

Anotochares englcharti Banks, 1939, Canad. Ent, 71: 228. [Type: ♀; Fredericksburg, Texas, 10 Oct. 1939 (G. Englehart); M. C. Z. no. 23,481.]

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[10] This species was presumably named after its collector, who is said by Banks to be G. Englehart; this in fact is the name as it appears on the label of the type. It seems likely that the collector was George P. Engelhardt. There may be some who would prefer to emend the specific name to *engelhardti*, but I prefer to retain the original orthography.

This is a striking species because of its large size, bluish coloration, very hairy body, and curious morphological features. The female is readily recognized by the strongly produced vertex; this character is less well-developed in the male, and it is sometimes necessary to examine the genitalia to separate males of this and the following species. The ranges of the two species do not appear to overlap in this country, but may do so in Mexico.

FEMALE.—Length 24 (19-30) mm. Color black, the pubescence refulgent of deep bluish, purplish, or blue-green; wings wholly deep fuliginous, violaceous, the pubescence on the wing, especially toward the base, reflecting the same color as that on the body. Scape slightly hairy; clypeus, front, vertex, and occiput clothed with short hairs; temples, propleura, and front coxae with dense, longer hair; thoracic dorsum with very short hair; pleurites and propodeum with dense, longer hair; all the coxae and femora hairy, often also the tibiae and tarsi to some extent; first abdominal tergite densely hairy in front, all the sternites and the apical tergites sparsely setose.

Transfacial distance about 1.05 × facial distance. Clypeus .8 the width of the lower front, a little over twice as broad as high. Antennae inserted low, on a prominence just above the clypeus, the front obliquely depressed on each side of the antennal bases. Front with a short but deep median furrow just above the antennal bases. Middle interocular distance about .7 × transfacial distance; upper interocular distance and lower interocular distance about equal; the former at least as great as the height of the eye. Vertex extended above the tops of the eyes a distance about equal to the width of an eye, its top nearly straight across, but with a slight median impression. Ocelli on a level with the eye-tops, far removed from vertex crest, the lateral ocelli being about as close to the eyes as to the crest of the vertex; ocello-ocular line much greater than post-ocellar line, the ocellar triangle rather flat. Temples strongly developed, especially above, wider than the eye. Scape long and the flagellum relatively short; first four antennal segments in a ratio of roughly 4:1:3.5:3.3, segment 3 equal to much less than half the upper interocular distance.

Propodeal declivity nearly vertical and actually longer than the anterior, horizontal part; median line of propodeum well impressed in front. Front tarsus and apex of tibia as shown in Fig. 9; the apex of the tibia is actually slightly emarginate between the stout, claw-like spines. Wings as described under the generic heading. Abdomen stout, the vertical portion of tergite 1 fitting closely against the propodeal declivity; sting very long when exserted.

MALE.—Length 19 (14-23) mm. Color of body and wings as in the female, the body much more hairy than in this sex. Scape densely hairy, the hairs short above, long below; clypeus and front densely hairy, the front especially so just above the antennal bases; vertex, occiput, and temples very hairy; thoracic dorsum densely short-haired; propodeum densely long-haired; pleura, coxae, and femora densely hairy, the tibiae slightly so; entire abdominal dorsum densely short-pilose, the venter similarly pilose except on the basal and apical sternites.

Clypeus about 1.7 × as broad as high, somewhat convex. Front broad, middle interocular distance about .65 × transfacial distance; inner orbits slightly divergent above. Vertex raised considerably above the tops of the eyes, but not so strongly as in the female, and more arcuately, without the median impression; seen in side view the upper temples and vertex are produced considerably above and behind the eyes (Fig. 15). Ocelli in a very flat triangle and much below the vertex crest, post-ocellar line much less than ocello-ocular line. First 4 antennal segments in a ratio of about 4:1:4:4; flagellum rather thick, its profile slightly crenulate.

Median line of propodeum well impressed; spiracles not their own length from the front margin of the propodeum. Abdomen with a well-defined constriction between the first two segments, and a very slight one between the next two. Subgenital plate slender, the apex narrowly rounded, the surface with only pubescence and a few weak hairs. Genitalia (Fig. 16) with the parameres strongly curved for their entire length, the lower inner margin thickened and densely clothed with short, stout setae. Digitus volsellaris strongly twisted, narrowly spatulate, the disc with scattered short setae and a number of longer ones on the upper, outer margin

Biology.—Mr. James E. Gillaspy, who to my knowledge is the only person to have collected this species in any series, has taken both sexes on the thorny shrub *Condalia obtusifolia* (Rhamnaceae). "They were taken," he says (*in litt.*), "in the mesquite country in Llano Co. [Texas] . . . females were taken flying in gladelike openings among mixed mesquite and oak at the brow of a rise some four or five hundred feet away from a tank or earthen reservoir. [Others] were taken several miles away, on the shrub which was growing in a broad, shallow stream bed among the mesquites." The species has also been taken "on Euphorbiaceae."

Distribution.—This is a Lower Sonoran form, ranging from central Texas southward and westward well into the Mexican states of Coahuila and Durango.

Specimens seen: 24 (13 ♀♀, 11 ♂♂). TEXAS: 1 ♀, 1 ♂ (no further data) [CU, ANSP]; Bastrop Co, 1 ♂ [JEG]; Blanco Co., 1 ♀, Round Mt. [ANSP]; Culberson Co., 1 ♀, Boracho, 22 June (Michener) [AMNH]; Dimmit Co., 1 ♀, Carrizo Springs, 11 June (Strandtmann) [RWS]; Gillespie Co., 1 ♀, Fredericksburg, 10 Oct. (Englehart) [MCZ]; Llano Co., 4 ♀♀, 3 ♂♂, 10–11 June (Gillaspy) [JEG]; Reeves Co., 2 ♀♀, Pecos, 19 June (A. T. McClay) [JEG]; Travis Co., 1 ♂, Austin [MCZ];

Uvalde Co., 2 ♂♂, Uvalde, 19 May (Bradley) [CU]; Valverde Co., 1 ♀, Devil's River, 6 May (Bishopp) [USNM]; Webb Co., 1 ♂, Laredo, 16 May [USNM]; Williamson Co., 1 ♀, Liberty Hill, 20 June (Strandtmann) [RWS]. MEXICO: Coahuila: 1 ♂, Buena Vista, 7000 feet, Sierra del Carmen, 12 July (R. H. Baker) [CIS]. Durango: 1 ♂, San Isidro, 6700 feet, 8 Aug. (Michener) [AMNH].

2. **Chalcochares hirsutifemur** (Banks) (Plate XI, figs. 10, 14, 17.)

Psammochares hirsutifemur Banks, 1914, Jour. N. Y. Ent. Soc., 22: 304. [Type: ♀; Lemon Grove, Calif., 16 May (Van Duzee); Mus. Comp. Zool., no. 13,691.]

Psammochares (*Chalcochares*) *hirsutifemur* Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.

Chalcochares hirsutipennis M. Smith, 1943, Zool. Record, v. 79, sect. 13, p. 134. [*Lapsus calami* for *hirsutifemur* Banks.]

This is a smaller species than *englcharti* and occurs farther west. It is very similar in appearance, but the vertex is only slightly produced above the tops of the eyes.

FEMALE.—Length 15.5 (12–19) mm Color black, rendered by the pubescence more or less bluish or violaceous; wings deep fuliginous, violaceous. Clypeus, front, vertex, and thoracic dorsum with abundant short hairs; temples, pro- and mesopleura, and propodeum with dense, longer hair; all the coxae and femora hairy, the tibiae slightly so; first abdominal tergite hairy in front, all the sternites and the apical tergites sparsely setose.

Transfacial distance about 1.12 × facial distance, the head therefore noticeably broader than high. Clypeus slightly more than twice as broad as high, about .9 as wide as the lower front. Front rather convex above the antennal bases, its median line faintly impressed below. Middle interocular distance about .67 × transfacial distance; lower interocular distance and upper interocular distance subequal, the latter about equal to the height of the eye. Vertex elevated in an even arc above the tops of the eyes. Ocelli in a flat triangle about on a level with the eye-tops; post-ocellar line: ocello-ocular line about as 3:4. Temples moderately developed, in lateral view not as wide as the eyes. First four antennal segments in a ratio of about 3:1:3:2.8, segment 3 equal to about half the upper interocular distance, or a little less.

Propodeal declivity oblique, approaching vertical, the declivous part about as long as the anterior, horizontal part; median line noticeably impressed at the top of the declivity. Tarsal characters about as in the preceding species; apical tarsal segments only weakly spined beneath. Vertical portion of first abdominal tergite fitting closely against the propodeal declivity; sting long when exserted.

MALE.—Length 13.5 (10–15) mm. Color of body and wings as in the female, the body much more densely hairy than in that sex, the distribution and abundance of hair exactly as described under the preceding species.

Clypeus somewhat less than twice as broad as high. Middle interocular distance about .67 × transfacial distance; upper and lower interocular distance nearly equal. Vertex raised in an arc above the eye-tops, but not as strongly as in *engleharti*, and the upper temples not as wide as in this species (Fig 14). Ocelli in a very flat triangle, post-ocellar line considerably less than ocello-ocular line Scape slender; first four antennal segments in a ratio of about 3.5 : 1 : 3 : 3.3, segment 3 usually shorter than 4 and not much more than twice as long as thick.

Median line of propodeum weakly impressed in front, more strongly toward the edge of the declivity. Abdomen faintly constricted between the first and second segments. Subgenital plate and genitalia very similar to those of *engleharti*; the parameres, however, are somewhat less strongly curved, and the inner margin is densely bristly for a greater proportion of its length (Fig 17).

Biology.—I have taken this species on the flowers of *Tamarix gallica* in the New Mexico desert. It has also been taken on *Acacia*.

Distribution.—Lower Sonoran fauna, southern New Mexico to California.

Specimens seen: 24 (14 ♀♀, 10 ♂♂). NEW MEXICO: Hidalgo Co., 1 ♂, Steins, 14 July (Bradley) [CU]; Otero Co., 1 ♀, 1 ♂, 12 mi. SW of Alamogordo, 27 July (Evans) [HEE]; 1 ♂, White Sands, 30 June (R H Beamer) [UK]; ARIZONA: 1 ♀ (no further data) [ANSP]; Cochise Co., 1 ♀, Portal, Chiricahua Mts., Aug. [CAS]; 1 ♀, San Bernardino Valley, 2 mi. SW of Chiricahua, 4650 feet, July (Pate) [ANSP]; 3 ♀♀, Douglas, 22 Aug. (W. W. Jones) [USNM]; Santa Cruz Co., 1 ♀, Washington Mts., near Nogales, 7 Sept. [CAS]; CALIFORNIA: Inyo Co., 1 ♀, 2 ♂♂, Big Pine Creek, 8–11,000 feet, Aug. (I. McCracken) [CAS, CIS]; Los Angeles Co., 1 ♂, Pasadena, 17 July (Bridwell) [USNM]; Marin Co., 1 ♂, Manor, 28 July (Williams) [CIS]; Orange Co., 1 ♀, Newport Bay, 6 Aug. (P. D. Hurd) [CIS]; Riverside Co., 1 ♂, Idyllwild, 14 July [CIS]; San Bernardino Co., 1 ♂, Colton [MCZ]; 1 ♀, Redlands, 3 July [CU]; San Diego Co., 1 ♀, Lemon Grove, 16 May (VanDuzee) [MCZ]; 1 ♀, San Diego [MCZ]; 1 ♀, San Felipe Valley, 6 June [CIS]; Santa Barbara Co., 1 ♂, Santa Barbara, 27 June [MCZ].

III. Genus **EVAGETES** Lepeletier

Evagetes Lepeletier, 1845, Hist. Nat. Ins. Hymen., III, p. 390. [Type: *Aporus bicolor* Lepeletier, 1845 (=*dubius* Van der Linden, 1827); monobasic.]

Eyagates Lucas, 1852, Ann. Soc. Ent. France, (2) 10: 418. [Typographical error for *Evagetes* Lepeletier.]

Evagethes Smith, 1858, Cat. Brit. Foss. Hymen. Brit. Mus., pp. 53, 79. [Emendation for *Evagetes* Lepeletier.]

Pompilus Groups 3, 4, & 5 Kohl, 1884, Verh. zool.-bot. Ges. Wien, 34: 39–55.

Sophropompilus Howard, 1901, The Insect Book, p. VII, fig. 13. [Type: *Pompilus ingenuus* Cresson, 1867; monobasic.] New synonymy.—Ashmead, 1902, Canad. Ent., 34: 84. [Proposed as a new genus.]—Banks, 1911, Jour. N. Y. Ent. Soc., 19: 224.—Dreisbach, 1949, Ent. Amer., (n.s.)29: 8, 12.

Nannopompilus Ashmead, 1902, Canad. Ent., 34: 82. [Type: *Nannopompilus argenteus* Ashmead MS (nomen nudum);[20] monobasic.] New synonymy.—Banks, 1919, Bull. Mus. Comp. Zool., 63: 230.—Dreisbach, 1949, Ent. Amer. (n.s.) 29: 8, 9.

Nanopompilus Banks, 1914, Jour. N. Y. Ent. Soc., 22: 301. [Emendation or *lapsus calami* for *Nannopompilus* Ashmead.]

Psammochares crassicornis-group Haupt, 1927, Deutsch. Ent. Zeitschr., Beiheft, pp. 154, 210.

Psammochares (*Evagetes*) Haupt, 1927, Deutsch. Ent. Zeitschr., Beiheft, pp. 158, 166, 227.

The generic name *Evagetes* has always been used for certain Old World Pompilini which are structurally somewhat diverse but resemble one another in the loss of the 2d transverse cubital vein, thus having but 2 submarginal cells. A number of European authors have noted the resemblance of *dubius,* the genotype, to *Pompilus crassicornis* and its allies (*Sophropompilus* Howard). All the other species of *Evagetes* have now been removed to other genera. When, however, we remove *dubius* to *Sophropompilus,* an inevitable step, we find that the name *Evagetes* has priority and must be used for this group. I have studied specimens of both sexes of *Evagetes dubius,* and found them extremely similar to European and American species formerly placed in *Sophropompilus*. The male genitalia and subgenital plate of *dubius* (Figs. 18 and 34) conform closely to the pattern of the American species. Specimens of several species are not rare in which there are but two submarginal cells in one wing and three in the other (this was noted by Shuckard in *crassicornis* as early as 1835); I have seen one specimen of *padrinus* Viereck with but two submarginal cells in each wing. Not a single character of any significance can be found which will save the genus *Sophropompilus* (along with *Nannopompilus*) from synonymy with *Evagetes*.

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[20] It has usually been considered that *Nannopompilus argenteus* Ashmead MS was in reality *Pompilus argenteus* Cresson, 1867 (=*parvus* Cresson, 1865). Ashmead, in characterizing the new genus in his key, states, however that the cubitus in the hind wing originates "before the transverse median nervule" and the "claws in the ♀ [are] cleft." These characters certainly do not fit Cresson's *argenteus,* although certain other characters presented do. It seems best to credit this confusion to Ashmead's lack of care in the preparation of his keys, and to continue to consider *argenteus* Cresson the genotype of *Nannopompilus.* See also Pate, 1946, Trans. Amer. Ent. Soc. 72: 96, footnote.

The most characteristic feature of this genus is the short antenna; in the female the flagellum is thickened toward the middle and the segments somewhat flattened on one side, the flattened area highly sensory. As the female walks over the sand the antennae are applied constantly to the surface; by this means she is apparently able to perceive the nests of certain species of Pompilini beneath the sand, for the members of this genus appear to be social parasites of other Pompilini (see further discussion under *Biology*). This, incidentally, is another reason for considering this group of generic rank, rather than a subgenus or species-group of *Pompilus*. Further morphological characters are in the much reduced pulvillar pad and comb, and the very broad front and vertex.

The species of *Evagetes* are in most cases extremely variable, not only in size and vestiture, but in almost every structural character that is customarily used in separating the species. The shape of the pronotum, length of the comb spines, length of the antennal segments, venation, hairiness of the body, and even to some extent the male genitalia, are all subject to so much variation that they can be used only with reservation. It is possible that this variability is explainable from their biology, for we would expect a large range in size, at least, in forms which are social parasites of a number of different species of spider wasps. A great deal of careful work needs to be done on this genus, particularly with respect to the habits and life-histories of its various members, some of which are among our most common Pompilidae.

Generic characters.—Small to medium-sized wasps, 4 to 18 mm. in length. Color black or with the base of the abdomen marked with rufous. Pubescence variable, but frequently obscurely to brilliantly dark metallic-refulgent, sometimes rendering the insect strongly bluish in appearance; pubescence sometimes very extensively silvery, at other times brownish and inconspicuous.

Labrum exserted slightly or not at all, its apical margin truncate or feebly emarginate. Mandibles in both sexes with but a single distinct tooth on the inner margin. Clypeus broad, but never broader than the front, its apical margin truncate or very slightly arcuately concave. Malar space present, not greater than the length of the antennal pedicel. Front and vertex very broad; middle interocular distance at least .6 the transfacial distance. Antennae short, never capable of reaching the abdomen, in the female with a tendency to be thickened toward the middle of the flagellum, the segments flattened somewhat on one side. Third segment of antenna in the female not more than 2.8 × as long as its greatest thickness, never more than very slightly longer than the 1st or 4th segments, and never equal to more than .6 the upper interocular distance. Antenna of male with the 3d segment distinctly shorter than the fourth and not over twice as long as thick, usually less. (See Figs. 25, 26, 29–31.)

Pronotum shorter than the mesonotum, never sharply angulate behind, either arcuate or broadly subangulate (Figs. 25, 26 and 27). Postnotum very short, depressed medially. Propodeum without protuberances or striations, but in the female with a rather well-defined oblique declivity behind. Legs moderately spinose; female with a few median spines beneath the apical tarsal segments, the male usually without. Front tarsus of female with a well-developed comb, the spines at least as long as the tarsus is wide, usually much longer (Figs. 3–6). Last segment of front tarsus of male (Fig. 8) barely to rather strongly asymmetrical, the inner margin more or less produced, the claw on the inner side strongly curved, the rays widely separated, the outer claw more like those of the other tarsi, either dentate or bifid. Middle and hind tarsal claws of the male, and all the claws of the female, dentate. Pulvillar comb (Fig. 7) very weak, of at most about seven weak, diverging setulae arising from a small pad.

Hind wings with the anal lobe small, less than half the length of the submedian cell; anal vein meeting the media usually slightly before the origin of the cubitus. Transverse median vein of the fore wing meeting the media beyond or at the origin of the basal. Stigma short; marginal cell more than its own length from the wing-tip, the radial vein usually somewhat angled at the 3d transverse cubital vein. The 1st and 3d transverse cubital veins arcuately approaching above; 2d erect, nearly straight, occasionally absent; 3d submarginal cell always much narrowed above, sometimes triangular. (See Figs. 12 and 13.)

Abdomen of female stout, the pygidium without bristles. Abdomen of male much more slender. Male subgenital plate simple, the median line usually slightly elevated; near the base are usually a pair of raised, sclerotized points or a pair of carinae (as in Figs. 33, 34 or 32). Genitalia with the parameres slender and moderately long, the squamae fairly prominent.

Digitus of variable shape, more or less expanded apically, clothed ventrally with short setae. Basal hooklets single or feebly doubled. Parapenials simple and slender. Aedoeagus of moderate breadth, the shaft often bearing small setae. The genitalia of the genotype are shown in Fig. 18.

Biology.—From what is at present known of the biology of the species of this genus, it appears that they are all social parasites of other Pompilini. Our knowledge of their habits is traceable, as is so often the case, to the observations of Ferton [21] and Adlerz [22] in Europe, and the Peckhams [23] in America. Richards and Hamm [24] present an excellent summary in English of what is known of the European species.

According to Ferton, the female *E. crassicornis,* walking with her antennae in rapid motion over the surface of the sand, is able to perceive the whereabouts of the filled nest of a Pompilid in the sand. When one is located, the wasp digs a hole in the sand until the cell is found which contains the paralyzed spider, on which an egg has been laid by the host species. Thereupon the *crassicornis* proceeds to destroy the host egg and lay her own, and then refill the burrow. The form of parasitism is very different from that of *Ceropales,* and is much more like that of the sphecid *Stizus unicinctus,* as described by the Raus,[25] which behaves in a similar manner toward *Prionony.x.* Adlerz confirmed Ferton's observations on *crassicornis,* and observed this species in a glass tube, actually devouring the egg of *Pompilus unguicularis.* The known hosts of *E. crassicornis* are *Episyron* spp. and *Pompilus unguicularis* Thomson. *E. pectinipes* (L.) is known to parasitize *Pompilus scelestus rufus* (Haupt) and *Episyron rufipes* (L.) in a similar fashion.

The North American *E. parvus* (Cresson) has been observed by the Peckhams (under the name *subviolaceus* Cresson) to lurk in the background while *Pompilus scelestus* Cresson completed her nesting in a garden. When *scelestus* had left, *parvus* suddenly appeared on the scene and began to dig, in this case unsuccessfully, where the former had filled her burrow. I have observed this same species on two occasions entering the burrows of *Anoplius marginatus* (Say), in one case while the *marginatus* female was still in it. I have also noticed *E. padrinus minusculus* (Banks) haunting the nesting-site of *Anoplius relativus* (Fox). The most detailed observations on the habits of an American species are those recently made by the author on *Evagetes hyacinthinus* (Cresson), which is a social parasite of *Anoplius americanus* (Beauvois); these are discussed under that species.

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[21] Ferton, C. 1901-1905, Ann. Soc. Ent. France, 70. 116, 71: 519, and 74: 73.

[22] Adlerz, G., 1910, K. Svensk. Vet.-Akad. Handl., 45: 13.

[23] Peckham, G. W. and E. G., 1905, Wasps Social and Solitary, pp 236, 240.

[24] Richards, O. W. and A. H. Hamm, 1939, Trans. Soc. Brit. Ent., 6: 88–89.

[25] Rau, Phil & Nellie, 1918, Wasp Studies Afield, pp. 180–193.

The habits of the genotype, the European *dubius* (Van der Linden), have apparently not been observed. Ferton[26] has published certain notes on a spider-hunting wasp which he called *dubius*, but he later[27] discovered that these were based on misdetermined specimens. He suggests, in fact, that the real *dubius* may be a parasite of other Pompilidae, quoting Wesmael, who as early as 1851 noted the resemblance of *dubius* to *pectinipes* L. and suggested that both were probably parasites. And yet for exactly one century no one has had the courage to place *dubius* and the *pectinipes-crassicornis* group together in the same genus, and to state unequivocally that this genus is parasitic in habit—all because a single very small vein is lacking in the fore wing of *Evagetes dubius!*

Distribution.—Palaearctic, Nearctic, and Neotropical Regions. It is possible that the African *argenteodecoratus* Cameron belongs here, although I have not seen specimens and hence cannot assign it definitely. This species is the genotype of *Asthenoctenus* Arnold. I recognize six species of *Evagetes* in our fauna, two of them polytypic.

Key to Species

Females

1. Posterior margin of pronotum broadly arcuate, at most with a very small angulate notch at the middle (Figs. 25 and 27); body rendered by the pubescence more or less brilliantly bluish, violet or blue-green 2

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[26] Ferton, C., 1897, Actes Soc Linn. Bordeaux, 52: 19, 33.

[27] Ferton, C., 1921, Ann. Soc. Ent. France, 89: 352-353.

Posterior margin of pronotum angulate or subangulate, rarely nearly arcuate (Fig. 26, though the angulation not always this distinct); pubescence at most obscurely reflecting metallic colors 6

2. Front and hind wings wholly and uniformly deep fuliginous; body wholly without silvery pubescence, even on the lower front; submedian cell of hind wing usually broadly rounded or somewhat truncate apically, sometimes appendiculate (Fig. 12); size 10.5 to 18 mm.
1. **ingenuus** (Cresson)

Wings not wholly fuliginous (when nearly so, the lower front, at least, silvery-sericeous); submedian cell of hind wing pointed or narrowly rounded apically, never appendiculate (Fig. 13) 3

3. Front basitarsus with three short comb-spines, the apical one not equal to more than .8 the second tarsal segment (Fig. 3); color dark bluish or purplish, not very brilliant, at most in small part silvery-sericeous
2. **parvus** (Cresson)

Front basitarsus more strongly spined, either with three comb-spines, the apical one subequal to or longer than the second segment, or with four or five comb-spines; body rather brilliantly metallic-refulgent and/or extensively silvery 4

4. Front basitarsus with from 3 to 5 (usually 4) comb-spines, the spines somewhat broad and flat, the apical one on the basitarsus subequal to or a little longer than the 2d tarsal segment (Fig. 4); propodeum at least slightly hairy; 3d submarginal cell usually as wide below as the 2d, or wider ....4. **hyacinthinus** (Cresson)

Front basitarsus with 3 very long, slender comb-spines, the apical one considerably longer than the 2d tarsal segment (Fig. 6); propodeum without erect hair; 3d submarginal cell small, usually shorter above and below than the 2d, often triangular 5

5. Body brilliantly bluish or blue-green (fading to violet in older specimens); head and thorax sometimes more or less silvery-sericeous, the abdomen, at least the dorsum, never so
3a. **padrinus padrinus** (Viereck)

General appearance paler, the silvery pubescence very extensive, involving most of the head and thorax and part or all of the abdomen
3b. **padrinus minusculus** (Banks)

6. Propodeum with numerous erect hairs; color black, the pubescence deep blue-black; front basitarsus with 3 or 4 very long comb-spines, the apical one usually longer than the 2d tarsal segment (Fig. 5)
5. **subangulatus** (Banks)

Propodeum very slightly or not at all hairy; color black or black and rufous; pubescence not at all reflecting bluish; front basitarsus with 3 (rarely 4) comb-spines, the apical one slightly if at all longer than the 2d tarsal segment 7

7. Base of the abdomen with at least a small amount of rufous, usually with the greater part of the basal 2 or 3 segments above and below rufous; length 8.5 (6–11) mm.
6a. **crassicornis crassicornis** (Shuckard)

Wholly black; length averaging slightly less, 7.5 (5–9) mm.; 3d submarginal cell usually triangular, sometimes petiolate
6b. **crassicornis consimilis** (Banks)

Males

(Certain species of *Pompilus* and *Agenioideus* with short antennae will occasionally key out to this genus, and are therefore included in the following key.)

a. Apical margin of clypeus convexly rounded, the clypeus less than twice as broad as high; posterior pronotal margin with a pale stripe; subgenital plate with a pair of basal palpus-like processes (visible only upon dissection) .... **Pompilus (Hesperopompilus)**, 2 spp.

Apical margin of clypeus truncate, the clypeus at least twice as broad as high; pronotum without a pale stripe; subgenital plate without such processes ....b

b. Marginal cell very long, less than its own length from the apex of the wing; stigma very large; apex of abdomen compressed, the subgenital plate strongly so, though the apical abdominal segments are usually telescoped into the basal ones
Agenioideus (Gymnochares) birkmanni (Banks)

Marginal cell at least its own length from the wing-tip; stigma small or of moderate size; subgenital plate not strongly compressed c

c. Abdominal tergites 2–4 each with a sharply defined band of coarse silvery pubescence along the apical margin, the remainder of the tergite with much finer, brownish pubescence; 3d submarginal cell very much smaller than the 2d, usually petiolate; sternite 6 with a specialized median area set off by a carina
Pompilus (Ammosphex) phoenix Evans

Abdominal tergites not banded with silvery pubescence, or if so, the pubescence is all very fine, and the bands are basal, not apical; sternite 6 without a specialized area set off by a carina 1

1. Subgenital plate with a pair of prominent carinae near the base (Fig. 32); digitus of genitalia with an apical nasutiform lobe (Fig. 22); color black or black and rufous, the pubescence not reflecting bluish ..2

Subgenital plate with a single median carina for its entire length or none at all; digiti without such a lobe apically; color black, the pubescence variable 3

2. Basal abdominal tergites marked with at least a small amount of rufous
6a. **crassicornis crassicornis** (Shuckard)

Wholly black ....6b. **crassicornis consimilis** (Banks)

3. Subgenital plate with the median line elevated in the form of a ridge which is arcuate in profile (Fig. 28); 3d submarginal cell small, shorter above and below than the 2d, sometimes petiolate 4

Median line of subgenital plate only feebly elevated (Fig. 33); 3d submarginal cell usually at least as wide below as the 2d 5

4. Body often extensively silvery-sericeous, but noticeably reflecting bluish at least on the thoracic dorsum and part of the abdomen
3a. **padrinus padrinus** (Viereck)

Body almost entirely silvery, a small part of the thoracic dorsum and abdomen brownish-pubescent or brownish-violaceous, but never noticeably bluish ....3b. **padrinus minusculus** (Banks)

5. Front and hind wings wholly and almost uniformly deep fuliginous; submedian cell of hind wing usually broadly rounded or somewhat truncate apically, sometimes appendiculate (Fig. 12); 3d antennal segment about twice the length of the 2d, which is very short (Fig. 29)
1. **ingenuus** (Cresson)

Wings not wholly fuliginous; submedian cell of hind wing pointed or narrowly rounded apically, never appendiculate (Fig. 13); 3d antennal segment not twice the 2d 6

6. Posterior margin of pronotum subangulate; vestiture deep blue-black, nowhere silvery; digiti of genitalia subclavate, the apex scarcely extended inward (Fig 23) ....5. **subangulatus** (Banks)

Posterior pronotal margin arcuate, at most with a slight median notch; pubescence markedly bluish and/or silvery; digiti to some extent produced inward at the apex 7

7. Propodeum without more than a very few inconspicuous erect hairs on the sides apparent above the coarse silvery pubescence; front barely to moderately hairy; digiti less strongly extended inward apically, sparsely and rather uniformly setose (Fig. 20) .....2. **parvus** (Cresson)

Propodeum usually with noticeable dark erect hairs; front with abundant erect hairs just above the antennal bases; digiti slightly more strongly extended inward apically, clothed with numerous short setae which tend to be crowded toward the upper, outer angles (Fig. 21)
4. **hyacinthinus** (Cresson)

1. **Evagetes ingenuus** (Cresson) new combination

(Plate X, fig. 7; plate XI, fig. 12; plate XII, fig. 19; plate XIII, fig. 29.)

Pompilus ingenuus Cresson, 1867, Trans. Amer. Ent. Soc., 1: 89. [Lectotype: ♀; Dakota Territory (no further data); A.N.S.P. no. 419.]—[?] Cresson, 1872, Trans. Amer. Ent. Soc., 4: 202. [TEXAS.]—Dälla Torre, 1897, Cat. Hymen., VIII, p. 296.

Sophropompilus ingenuus Howard, 1901, The Insect Book, pl. VII, fig. 13.—Ashmead, 1902, Canad. Ent., 34: 84.—Strickland, 1947, Canad. Ent., 79: 124. [Medicine Hat, Alta.]

Anoplius (Ferreola) ingenuus Viereck, 1906, Trans. Amer. Ent. Soc., 32: 241. [Colorado Springs, Colo.]

Anoplius ingenuus Smith, 1910, Ann. Rpt. N. J. State Mus., 1909, p. 674. [N. J.]

Psammochares (Sophropompilus) ingenuus Banks, 1911, Jour. N. Y. Ent. Soc, 19: 224.—Banks, 1917, Bull. Mus. Comp Zool., 61: 107.—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 988. [N. Y., several localities.]—Johnson, 1930, List Ins. Fauna Nantucket, p. 111.—Brimley, 1936, Jour. Elisha Mitchell Sci. Soc, 52: 126. [N. C., several localities.]—Brimley, 1938, Insects N. Carolina, p. 434.

This species is placed first in the genus because of certain resemblances to members of the preceding genus, *Chalcochares*. For example, the anal vein of the hind wing is often much the same as in that genus, the flagellum of the male is moderately long, not notably shorter than that of the female, the wings are wholly fuliginous and the pubescence of the body deep bluish or purplish, and some specimens even show faint constrictions between the basal abdominal segments. However, the tarsal comb is well developed as in all the species of *Evagetes*, and there are numerous other generic differences. *E. ingenuus* is the largest species of the genus; it is widely distributed but not at all common.

FEMALE.—Length 14 (10.5–18) mm Color black, the body rendered by the pubescence a deep glossy blue, blue-violet, or purplish; pubescence never even in small part silvery. Wings wholly and uniformly fuliginous, violaceous. Scape below, clypeus, front, vertex, temples, entire thorax and propodeum, coxae, and often to some extent the femora, with rather abundant short black erect hair.

Head considerably broader than high, transfacial distance about 1.2 × facial distance. Clypeus about 3 × as broad as high. Front strongly convex, especially just above the antennal orbits, and very broad, middle interocular distance .62–.66 × transfacial distance. Inner orbits converging slightly above, upper interocular distance .85–.95 × the lower. Post-ocellar line is to ocello-ocular line about as 3:4, the ocelli forming an obtuse angle in front. First 4 antennal segments in a ratio of about 3:1:2.8:2.8, segment 3 about twice as long as its greatest thickness, and equal to from .35 to .45 × upper interocular distance, segment 6 a little over twice as long as thick; flagellum somewhat thickened toward the middle and the segments a bit flattened on one side. Temples very narrow; vertex elevated very slightly above the tops of the eyes.

Posterior margin of pronotum broadly arcuate, with or without a slight median notch. Propodeum short, with a well-defined slightly concave declivity. Front tarsus with a comb of slender or moderately stout, sometimes brown-tipped, spines; the basitarsus bears 3, occasionally 4, comb-spines, the apical one usually a little shorter than the 2d tarsal segment. Wings as shown in Fig. 12; the submedian cell of the hind wing is usually broadly rounded or somewhat truncate apically and sometimes appendiculate, but there is considerable variation in this character.

Male.—Length 13.5 (10.5–17) mm. Color of integument, pubescence, and wings as in female; never with even a trace of silvery pubescence. Scape hairy below; front rather densely hairy; remainder of head, thorax, and propodeum with moderately abundant short hairs; coxae slightly hairy; first abdominal tergite and sternites 2–6 slightly hairy.

Clypeus from 2.3 to 2.6 × as broad as high. Front broad, middle interocular distance from .61 to .66 × transfacial distance; inner orbits subparallel or diverging very slightly above. Ocelli small, in a broad, flat triangle, post-ocellar line slightly less than ocello-ocular line. First 4 antennal segments (Fig. 29) in a ratio of about 3:1:2.2:2.8, segment 2 relatively shorter than in other species of this genus, segment 3 only slightly less than twice as long as thick.

Posterior pronotal margin arcuate or subarcuate. Propodeum with the median line impressed in front, the declivity well-defined, short. Last segment of front tarsus distinctly asymmetrical; inner claw of this tarsus strongly curved, the outer like those of the middle and hind tarsi. Wing venation as in the female.

Emargination of sternite 6 large, V-shaped. Subgenital plate weakly elevated medially, the apex rounded, the margin spinose (not differing noticeably from that of *parvus*, shown in Fig. 33). Genitalia (Fig. 19) with the basal hooklets distinctly double, the lower pointed processes well-defined; digitus broadened and strongly curved apically, the disc clothed with short setae; aedoeagus rather broad, with a submarginal row of setae on the apical half and a few setae at the apex.

Biology.—This species is characteristic of sand dunes and other open, sandy areas. It is attracted to honeydew and to flowers, particularly to *Solidago* spp., but also to *Daucus carota.* It is essentially a mid-summer species, and there appears to be a single generation a year.

Distribution.—This form occurs transcontinentally in the Upper Austral Zone and the lower fringes of the Transition Zone, but is nowhere common.

Specimens seen: 110 (61 ♀♀, 49 ♂♂). The following are marginal records: Quebec: 1 ♂, Norway Bay, 2 July [CNC]; Ontario: 1 ♀, St. Thomas, 23 Aug. [CNC]; Michigan: Newaygo Co., 1 ♂, 31 July [MCZ];

Minnesota: Big Stone Co., 1 ♀, Ortonville, 5 Aug. [Minn.]; Dakota Territory: 1 ♀ [type, ANSP]; Alberta: 1 ♀, Medicine Hat [Alta.]; British Columbia: 1 ♀, Okanagan, 30 July [CNC]; California: Orange Co., 1 ♀, Newport Bay, July [CIS]; Arizona: Cochise Co., 1 ♀, Huachuca Mts., June [CAS]; Colorado: Yuma Co., 1 ♀, Wray, 17 Aug., 3700 feet [AMNH]; Kansas: Meade Co., 1 ♂, 10 July [UK]; Iowa: Dickinson Co., 1 ♀, 23 June [CU]; Georgia: Dade Co., 1 ♀, Sitton's Gulch, July [EU].

2. **Evagetes parvus** (Cresson) new combination (Plate X, fig. 3; plate XI, fig. 13; plate XII, fig. 20; plate XIII, figs. 27, 31, 33.)

Pompilus parvus Cresson, 1865, Proc. Ent. Soc. Phila., 4: 453. [Type: ♀; Colorado (no further data); A.N.S.P. no. 549.]—Cresson, 1867, Trans. Amer. Ent. Soc., 1: 91.—Provancher, 1889, Faune Ent. Canad., Hymen., Add. and Corr., p. 260–261.—Dalla Torre, 1897, Cat. Hymen., VIII, p. 309.

Pompilus subviolaceus Cresson, 1867, Trans. Amer. Ent. Soc., 1: 91. [Lectotype: ♀; Delaware (no further data); A N S P. no. 551.] New synonymy.—Dalla Torre, 1897, Cat. Hymen., VIII, p. 325.—Peckham and Peckham, 1905, Wasps Social and Solitary, pp. 236 and 240. [Biology.]

Pompilus argenteus Cresson, 1867, Trans. Amer. Ent. Soc., 1: 93. [Lectotype: ♂; Virginia (no further data); A.N.S.P. no. 556.] New synonymy.—Provancher, 1883, Nat. Canad., 14: 35. [Quebec.]—Provancher, 1889, Faune Ent. Canad., Hymen., Add. and Corr., p. 260.—Dalla Torre, 1897, Cat. Hymen., VIII, p. 274.

Nannopompilus argenteus Ashmead, 1902, Canad. Ent., 34: 82. [See footnote under generic synonymy.]—Strickland, 1947, Canad. Ent., 79: 124. [Alberta.]—Dreisbach, 1949, Ent. Amer. (n.s.)29: 40, pl. IV, fig. 19.

Anoplius (Ferreola) subviolaceus Viereck, 1906, Trans. Amer. Ent. Soc., 32: 232, 245. [Williams, Ariz., and Lusk, Wyo.]

Anoplius argenteus Smith, 1910, Ann. Rpt. N. J. State Mus. 1909, p. 674. [N. J.]

Anoplius subviolaceus Smith, 1910, Ann. Rpt. N. J. State Mus. 1909, p. 674.

Pompiloides minora Banks. 1911, Jour. N. Y. Ent. Soc., 19: 227. [Type: ♀; Falls Church, Va., 2 Aug. (Banks); Mus. Comp. Zool., no. 13,671.] New synonymy.

Pompiloides (Nanopompilus) argenteus Banks; 1914, Jour. N. Y. Ent. Soc., 22: 301.

Pompiloides (Nanopompilus) parvus Banks, 1914, Jour. N. Y. Ent. Soc., 22: 301.

Pompiloides (Pompiloides) subviolaceus Banks, 1914, Jour. N. Y. Ent. Soc., 22: 301.

Pompiloides argenteus Rohwer, 1916, Conn. Geol. Nat. Hist. Survey Bull. 22, pp. 631–632. [Conn.]—Robertson, 1928, Trans. Acad. Sci. St. Louis, 25: 308, 317.

Pompiloides subviolaceus Rohwer, 1916, Conn. Geol. Nat. Hist. Survey Bull. 22, pp. 631–632.—Robertson, 1928, Trans. Acad. Sci. St. Louis, 25: 308, 317.

Psammochares (*Nannopompilus*) *argenteus* Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 988. [N. Y.]—Brimley, 1938, Insects N. Carolina, p. 434. [N. C.]

Psammochares (*Nannopompilus*) *parvus* Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.

Psammochares (*Pompiloides*) *minora* Banks, 1917, Bull. Mus Comp. Zool., 61: 107.—Brimley, 1936, J. Elisha Mitchell Sci. Soc., 52: 124–125.—Brimley, 1938, Insects N. Carolina, p. 433.

Sophropompilus parvus Banks, 1919, Bull. Mus. Comp. Zool., 63: 237-238. [Calif., Wash., B. C.]—Strickland, 1947, Canad. Ent., 79: 124.

Psammochares (*Sophropompilus*) *subviolaceus* Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 988.

Psammochares (*Pompiloides*) *argenteus* Brimley, 1936, J. Elisha Mitchell Sci Soc., 52: 124–125.

As the long synonymy suggests, *parvus* is a widely distributed and relatively common species, and also highly variable. In general it suggests a diminutive *ingenuus*, but is separable from this species by the much paler wings and more pointed submedian cell of the hind wing (Fig. 13 as compared with 12). From *padrinus* the female is separable by the much shorter comb-spines, the male by the lack of a high, arched carina on the subgenital plate. Separation from *hyacinthinus* is a more difficult matter, for the latter is also a highly variable species. *Parvus* averages smaller than *hyacinthinus;* the females are less extensively silvery-pubescent, often not at all so, and both sexes are less brilliantly metallic-pubescent; *parvus* tends to be somewhat more northern in its distribution. Individuals can scarcely be placed accurately by these generalities; however, the characters as expressed in the keys should serve to separate them in most cases. Here the crucial character in the female is the length of the spines of the tarsal comb. In *parvus* the spines are shorter, tapering, and usually wholly black, and there are but 3 on the basitarsus. In *hyacinthinus* the spines are longer and generally somewhat broad and flattened, often with pale tips, and there are usually 4 on the basitarsus, though there may be 3 or 5. Figures 3 and 4 illustrate typical specimens, but since the spines are subject not only to much individual variation but also to considerable wear, not every specimen should be expected to agree closely with the figures.

Female.—Length 8 (5–11.5) mm. Color black, rendered by the pubescence a dull to rather intense deep blue, fading to violet in older specimens; there may or may not be a small amount of silvery pubescence on the front, rarely on parts of the thorax. Front wings lightly to rather heavily infuscated, with a darker outer marginal band; hind wings subhyaline, darker apically. Clypeus, front, vertex, prothorax, and sometimes the coxae and mesopleura with sparse short, dark hair; propodeum very slightly or not at all hairy.

Features of the head exactly as described under *ingenuus*; middle interocular distance varies from .62 to .7 × transfacial distance; post-ocellar line is usually somewhat less than ocello-ocular line; the first 4 antennal segments are in a ratio of 2 : 1 : 2.8 : 2 8, segment 3 equal to from .33 to .45 × upper interocular distance. Posterior margin of pronotum (Fig. 27) arcuate or almost straight, rarely with a slight median notch. Propodeum with a fairly well-defined posterior declivity. Tarsal comb (Fig. 3) of short, tapering spines, usually black but occasionally pale tipped; there are 3 comb-spines on the basitarsus, the apical one varying from .4 to .8 the length of the second tarsal segment. Hind wing (Fig 13) with the submedian cell more or less pointed apically, or narrowly rounded, never appendiculate. Front wing much as in *ingenuus*; marginal cell usually about 1.3 × its own length from the wing-tip; 3d submarginal cell much narrowed above, sometimes nearly triangular; 2d and 3d subequal in maximum breadth, or the 3d slightly broader than the 2d.

Male—Length 6.5 (4.5–9) mm. Color black; pubescence conspicuously silvery over the greater part of the head and thorax, including the coxae and sometimes more of the legs, very coarse on the propodeum, and often forming basal silvery bands on some of the abdominal tergites; elsewhere the pubescence is brownish or somewhat bluish or purplish, but rarely conspicuously so; in some specimens from the Far West only the clypeus, front, metanotum, and propodeum are silvery. Wings hyaline, the outer margin of the fore wing and apex of the hind wing narrowly infuscated. Scape often slightly hairy below; clypeus, front, and vertex with sparse to fairly abundant short hairs; pronotum and front coxae slightly hairy; propodeum without erect hairs or with a very few dark hairs visible above the coarse silvery pile.

Clypeus about 2.5 × as broad as high. Middle interocular distance varying from .62 to .67 × transfacial distance; inner orbits diverging slightly above. Front convex, the line from the antennal bases to the anterior ocellus well-impressed. Ocelli forming a right or obtuse angle in front; postocellar line subequal to or less than ocello-ocular line. First 4 antennal segments (Fig. 31) in a ratio of about 2.5 : 1 : 1.5 : 1.8; segment 3 only slightly longer than thick. Posterior pronotal margin arcuate. Median line of propodeum impressed. Last segment of front tarsus modified as in the preceding species. Venation as in the female; the 3d submarginal cell varies from wide above to actually petiolate.

Abdomen slender; sternite 6 with the emargination broad and deep. Subgenital plate (Fig. 33) slightly variable in shape, the sides tapering to a narrowly rounded apex, the margin set with stout bristles, the median line weakly elevated; near the base are a pair of small, darkly pigmented raised points. Genitalia (Fig. 20) differing but slightly from those of *ingenuus*. Parameres slender, slightly curved; digiti broadened and curved apically, the disc clothed with scattered setae of moderate length; the portion of the digitus beyond the curvature is generally a little shorter than in *ingenuus* and *hyacinthinus*, longer than in *padrinus* and *subangulatus*. Basal hooklets essentially double, but the lower sclerotized points small or obsolescent. Parapenials and aedoeagus as in *ingenuus*, except the setae along the shaft of the latter, if at all visible, are very minute.

Gynandromorph—A specimen from Kings Co, Nova Scotia [CNC], is a mosaic of male and female characters. The abdomen and the meso- and metathorax and their appendages are entirely female. The prothorax is female except for the legs; the coxae are small, the legs slender and weakly spinose; the tarsal comb is partially developed on the left leg, absent on the right; the apical tarsal segment is produced on the inner margin very slightly; the inner claws of the front tarsus are modified as in the male. The head is a blending of male and female characters the shape is more that of the female, but the clypeus is only 2.5 × as broad as high; the right antenna is male, the left intermediate between the two sexes The lower front, clypeus, and temples are silvery-sericeous, also parts of the thoracic pleura, but the propodeum is wholly without silvery pubescence.

Biology.—This species frequents sand pits, waste places, gardens, and occasionally clearings in woodlands, where the females may often be found running along the ground with their wings and antennae in constant motion. There is no definite information, but considerable circumstantial evidence, that the species is a social parasite of other Pompilini. (See discussion under the generic heading.) The species visits honeydew, and is a frequent visitor to flowers, having been taken on *Daucus carota, Pastinaca sativa, Solidago, Angelica,* and *Cleome serrulata.* It occurs throughout the summer months, and possibly has several generations during this time.

Distribution.—Transcontinental in the Canadian, Transition, and Upper Austral Zones, but less common southward and westward; it is one of the commonest Pompilini in the northeastern and north central United States and eastern Canada; there are but few records from west of the Rocky Mountains.

Specimens seen: 503 (382 ♀♀, 120 ♂♂, 1 gynandromorph). The following are marginal records: NOVA SCOTIA: 1 ♀, Baddeck, Cape Breton Island, Aug. [MCZ]; PRINCE EDWARD ISLAND: 1 ♀, Brackley Beach, Canad. Nat. Park., 29 July [CNC]; QUEBEC: 1 ♀, Hemmingford, 27 June [CNC]; ONTARIO: 1 ♀, Constance Bay, 24 Aug. [CNC]; 6 ♀♀, 2 ♂♂, Ottawa, July–Sept. [CNC]; MICHIGAN: Midland Co., 3 ♀♀, Aug. [MCZ]; WISCONSIN: Wood Co., 1 ♀, Cranmoor, 16 Aug. [USNM]; MANITOBA: 4 ♀♀, Aweme, June-Sept. [CNC]; SASKATCHEWAN: 1 ♀, Waskesiu Lake, 22 July [CNC]; YUKON: 1 ♀, 1 ♂, Watson Lake, 25 June [CNC]; BRITISH COLUMBIA: 2 ♂♂, Carbonate, Columbia R., July [CU]; CALIFORNIA: Riverside Co., 1 ♀, San Jacinto, May [CAS]; ARIZONA: Cochise Co., 2 ♀♀, Rustler's Park, 9000 feet, Chiricahua Mts., 8 Aug. [HEE]; NEW MEXICO: San Miguel Co., 1 ♀, Pecos, 23 June [ANSP]; TEXAS: Brazos Co., 1 ♀, 25 Oct. [JEG]; MISSOURI: 1 ♀, St. Louis [USNM]; GEORGIA: Stephens Co., 1 ♀, Toccoa, 18 Aug. [CU].

3a. **Evagetes padrinus padrinus** (Viereck) new combination

(Plate X, fig. 6; plate XII, fig. 24; plate XIII, figs. 28, 30.)

Anoplius (Pompilinus) padrinus Viereck, 1902, Proc. Acad. Nat. Sci. Phila., 54: 734. [Type: ♂; San Pedro, Calif., 27 July, on *Euphorbia*; (not seen by author).] [26]

Pompiloides (Nanopompilus) padrinus Banks, 1914, Jour. N. Y. Ent. Soc., 22· 301.

Psammochares (Nannopompilus) padrinus Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.

Nannopompilus padrinus Banks, 1919, Bull. Mus. Comp. Zool., 63: 237.

Sophropompilus padrinus Strickland, 1947, Canad. Ent., 79: 124. [Medicine Hat, Alta.]

This beautiful little wasp can be confused with no other. The spines of the tarsal comb of the female are very long and slender; the 3d submarginal cell is very small, often triangular or petiolate; the propodeum is without erect hairs or practically so; the subgenital plate of the male possesses a strong carina which is arched in profile; the pubescence is brilliantly refulgent of metallic colors.

FEMALE.—Length 7 (4.5–9) mm. Color black, the body rendered by the pubescence an intense blue, violet, or blue-green. Pubescence of the lower front and clypeus silvery, also sometimes parts of the thorax, legs, and propodeum, but the abdomen never silvery, at least dorsally. Wings lightly

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[28] Viereck states following his description that his type is in the A.N.S.P. However, I have been unable to find the type in the collection of this institution, and assume it has been lost or destroyed.

to moderately infuscated, usually with an evident darker marginal band, somewhat iridescent or violaceous. Front and vertex with sparse, short, dark hairs; temples and propleura with pale hairs; apex of abdomen slightly setose; remainder of body practically devoid of erect hairs.

Head not quite as broad as in the two preceding species, transfacial distance about 1.15 × facial distance. Clypeus 2.4–2.7 × as wide as high, not quite as wide as the lower interocular distance. Front not especially broad for the genus, middle interocular distance varying from .59 to .63 × transfacial distance, the average .61. Front rather convex, with a strongly impressed line from the antennal bases to the front ocellus. Inner orbits slightly convergent above, upper interocular distance about .9 × the lower. Ocelli forming a right or acute angle in front; post-ocellar line subequal to or greater than ocello-ocular line. Antennae of moderate length for the genus; first 4 segments in a ratio of about 5 : 2 : 5 : 5, segment 3 sometimes slightly longer than 1 or 4, generally about 2.5 × as long as its maximum thickness, and equal to approximately half the upper interocular distance.

Posterior pronotal margin slightly arched, but almost straight across. Propodeum with a fairly well-defined oblique declivity; median line impressed in front. Front tarsus with a comb of unusually long and slender spines (Fig. 6), the third and apical one on the basitarsus distinctly longer than the 2d tarsal segment. Transverse median vein of fore wing meeting the media well beyond the origin of the basal. Stigma very small; marginal cell small, from 1.5 to 2 × its length from the wing-tip. 3d submarginal cell narrower than the 2d, much narrowed above by the arcuation of the 3d transverse cubital vein, usually triangular, not infrequently petiolate. Hind wing as in *parvus*.

MALE.—Length 5.5 (4–7) mm. Color of integument black; wings hyaline, the outer margins with a fuscous band. Pubescence conspicuously silvery and bluish-refulgent; some specimens are entirely bluish except on the front, temples, and clypeus, which are silvery (California specimens especially); at the other extreme are specimens almost entirely silvery-sericeous, except on the vertex, parts of the thoracic dorsum, and the greater part of the abdomen, which are bluish. Temples and propleura with considerable pale erect hair; clypeus, front, vertex, and pronotum usually with sparse, short, dark hair; abdominal sternites sparsely short-haired.

Clypeus 2.2 to 2.6 × as broad as high. Eyes diverging noticeably above, upper interocular distance 1.1 to 1.2 × the lower; front of moderate breadth, with a well-defined line from the antennal bases to the front ocellus. Ocelli in a rather large triangle, post-ocellar line equal to or greater than ocello-ocular line. First 4 antennal segments in a ratio of about 2.2 : 1 : 1 8 : 2, the third segment 1.5–1.8 × as long as thick (Fig. 30).

Posterior pronotal margin arcuate or very feebly angulate. Propodeum sloping rather evenly, its median line well impressed. Last segment of front tarsus slightly asymmetrical, the inner margin weakly produced, the inner claw strongly modified, the outer sub-bifid, the tooth a little stronger than that of the middle and hind tarsal claws and sloping outward somewhat. Venation as in the female.

Abdomen very slender. Sternite 6 with the emargination large, broadly V-shaped. Subgenital plate similar to that of *parvus* except that the median line is sharply elevated, forming a carina which is arched in profile, highest near the base (Fig. 28). Genitalia (Fig. 24) with the parameres slender, rather long-setose apically; basal hooklets double or the lower pair obsolescent; digiti much expanded beyond the base, the disc subtriangular, clothed with short setae; aedoeagus weakly spinose apically.

Biology.—This form occurs in small or large open sandy areas. It is frequently attracted to the ground beneath trees which are dripping honeydew. Males have been taken on the flowers of *Euphorbia* and *Tamarix*. It is on the wing throughout the summer season, and at the southern extremities of its range, throughout the year.

Distribution.—Lower and Upper Sonoran faunas and lower fringes of the Transition fauna; east of western Texas, Colorado, and Manitoba it is replaced by subspecies *minusculus*.

Specimens seen: 126 (80 ♀♀, 46 ♂♂). The marginal records are as follows. Manitoba: 1 ♀, Aweme, 11 Sept. [CNC]; Saskatchewan: 1 ♀, Great Sand Hills, W. of Swift Current, 29 May [CNC]; Alberta: 2 ♀♀, 1 ♂, Medicine Hat, June [Alta.]; British Columbia: 1 ♀, Creston, 13 Sept. [CNC]; California: San Diego Co, 1 ♀, Coronado, June [CAS]; Arizona: Pima Co., 1 ♀, Bear Canyon, Santa Catalina Mts., 7000 feet, Aug. [HEE]; New Mexico: Sandoval Co., 1 ♀, Jemez Springs, 7500 feet, Oct. [ANSP]; Texas: Brewster Co., 1 ♀, 3 ♂♂, The Basin, 5400 feet, Chisos Mts, 8–11 July [HEE]; Colorado: Larimer Co., 27 ♀♀, 31 ♂♂, Poudre Canyon, 5200 feet, beneath honeydewed willow, 19–22 Aug. [HEE]; Montana: Dawson Co., 3 ♀♀, Glendive [USNM].

3b. Evagetes padrinus minusculus (Banks) new combination

Psammochares minusculus Banks, 1910, Jour. N. Y. Ent. Soc., 18: 118. [Type: ♀; Fedor, Lee Co., Texas, 21 June 1909 (G. Birkman); Mus. Comp. Zool., no. 13,701.]

Pompiloides (*Nanopompilus*) *minusculus* Banks, 1914, Jour. N. Y. Ent. Soc., 22: 301.

Psammochares (*Nannopompilus*) *minusculus* Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.

This form is often misdetermined as *argenteus* Cresson, and it is possible that some of the references cited under that name (*cf. parvus* Cresson) really pertain to this form.

FEMALE.—Length 7 (4.5–9) mm. Black, pubescence silvery over the greater part of the head, thorax, and propodeum, and the abdomen with at least a little silvery pubescence on the basal tergites and sternites, elsewhere more or less bluish or blue-green; some specimens are almost entirely silvery, while an occasional specimen from within the range of this form is no more extensively silvery than typical *padrinus*. Middle interocular distance varies from .60 to .66 × transfacial distance, averaging about .63; antennal segment 3 usually equal to slightly less than half the upper interocular distance. In all other features very similar to the nominate subspecies.

MALE.—Length 5.5 (4.5–6.5) mm. Color black; pubescence over most of the head and thorax silvery and a little coarse; first 3 or 4 abdominal segments with basal silvery fasciae; pubescence of the vertex, parts of the thoracic dorsum, and the remainder of the abdomen brownish-violaceous, at most obscurely bluish. Morphological features as in typical *padrinus*.

Distribution.—Austroriparian and Carolinian faunas; like the typical subspecies, partial to sandy places.

Specimens seen: 100 (89 ♀♀, 11 ♂♂). The following are marginal records: NEW HAMPSHIRE: Hillsborough Co., 1 ♀, Pelham, 11 Sept. [USNM]; ONTARIO: 1 ♀, Ottawa, 3 Aug. [CNC]; MICHIGAN: Cheboygan Co., 1 ♀, Aug. [UK]; MINNESOTA: Polk Co., 1 ♀, 6 Sept. [Minn.]; SOUTH DAKOTA: Stanley Co., 1 ♀, White River, 15 Sept. [USNM]; KANSAS: 1 ♀, central part, Aug. [USNM]; TEXAS: Bexar Co, 1 ♀, San Antonio, 13 June [JEG]; LOUISIANA: St. Landry Co., 1 ♀, Opelousas [USNM]; ALABAMA. 1 ♀, Tuscaloosa, 22 May [HEE]; GEORGIA: Decatur Co., 1 ♂, Spring Creek, 16–29 July [CU].

4 **Evagetes hyacinthinus** (Cresson) new combination

Plate X, fig. 4; plate XII, fig. 21; plate XIII, fig. 25.)

Pompilus hyacinthinus Cresson, 1867, Trans. Amer Ent. Soc., 1: 90 [Type: ♀; Connecticut (no further data); formerly in the collection of Edward Norton.] [29]—Provancher, 1882, Nat. Canad., 13: 35, 37. [Quebec.]—Provancher, 1889, Faune Ent. Canad., Hymen., Add. and Corr., p. 260. —Dalla Torre, 1897, Cat. Hymen., VIII, p. 294.

Pompilus brevicornis Cresson, 1867, Trans. Amer. Ent. Soc., 1: 90. [Lectotype: ♂; Pennsylvania (no further data); A.N.S.P. no. 550.] New synonymy.—Dalla Torre, 1897, Cat. Hymen., VIII, p. 277.

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[29] I have not seen the type of this species, which is in all probability no longer extant. Parts of the Norton collection are now at the Peabody Museum, New Haven, Conn., but this specimen is not contained in the material there. My interpretation of the species is based wholly on the original description. A neotype selected by Nathan Banks [Colebrook, Conn., Aug. 1918 (W. M. Wheeler)] [MCZ] is in my estimation a specimen of *parvus* Cresson.

Pompilus castaneus Provancher, 1882, Nat. Canad., 13: 35, 39. [Lectotype: ♂; St. Hyacinthe, Quebec; Q.P.M. no. 774 (yellow label).] [*Nec* Klug, 1834.] New synonymy.—Provancher, 1883, Nat. Canad., 14: 35. [Said to be synonym of *argenteus* Cresson.]

Anoplius hyacinthinus Smith, 1910, Ann. Rpt. N. J. State Mus. 1910, p. 674. [N. J.]

Pompiloides (Nanopompilus) hyacinthinus Banks, 1914, Jour. N. Y. Ent. Soc., 22: 301.

Pompiloides castaneus Rohwer, 1916, Canad. Ent., 48: 372. [Stated to be synonym of *argenteus* Cresson.]

Psammochares (Arachnophila) scudderi Banks, 1917, Bull. Mus. Comp. Zool., 61: 104, 107. [Type: ♀; Winnipeg, Manitoba (Scudder); M C.Z. no. 10,018.] New synonymy.

Psammochares (Sophropompilus) hyacinthinus Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 988.—Johnson, 1930, List Insect Fauna Nantucket, p. 111.—Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 127.—Brimley, 1938, Insects N. Carolina, p. 434.

Psammochares (Sophropompilus) brevicornis Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 988.

Sophropompilus quadrispinosus Banks, 1919, Canad. Ent., 51: 82. [Type: ♀; Long Beach, L. I., N. Y., Aug. (Shannon); M.C.Z. no. 13,703.] [*Nec* Klug, 1886.] New synonymy.

Sophropompilus bradleyi Banks, 1919, Bull. Mus. Comp. Zool., 63: 237–238. [Type: ♀; Giant Forest, Sequoia Nat. Pārk, Calif., 21–26 July 1907, 6000–7000 feet (J. C. Bradley); C. U. no. 688.] New synonymy.

Psammochares (Sophropompilus) quadrispinosus Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 988.

Sophropompilus mohave Banks, 1933, Psyche, 40: 6. [Type: ♀; Tempe, Arizona, 1 Aug. (J. Bequaert); M.C.Z. no. 17,034.] New synonymy.

Sophropompilus hyacinthinus Procter, 1938, Biol. Survey Mt. Desert Reg., VI, Insecta, p. 430. [Mt. Desert, Me.]

Nannopompilus texanus Banks, 1944, Bull. Mus. Comp. Zool., 94: 170. [Type: ♀; Richmond, Fort Bend Co., Texas, 22 June 1917; M.C.Z. no. 25,895.] New synonymy.

Sophropompilus parvus Dreisbach, 1949, Ent. Amer., (n.s.)29: 38, pl. III, fig. 15. [*Nec* Cresson; misidentification.]

This is the most widely distributed and, at least southwardly, the most common species of the genus. In the female there are 4 (sometimes 3 or 5) comb-spines on the basitarsus; these spines are somewhat broadened and blade-like, and the apical one on the basitarsus is typically subequal in length to the 2d tarsal segment, although it may be somewhat longer or shorter. The head of the female is relatively broad and thin, the lower front and clypeus usually silvery-sericeous (and sometimes much more of the body).

This is an exceedingly variable species. The several new synonymies indicated above have been made only after a detailed study of several hundred specimens from many parts of this country and Canada. Certainly an examination of the types alone would convince one that several of them are good species. However, all possible intergrades between these various extremes occur; furthermore, I can find no evidence in the males for recognizing more than a single species. Efforts to retain certain of these names for geographical races have failed, because of the at most very rough correlation of variation with geography, and the lack of characters in the males. Those who believe in the naming of "forms," based on one sex and having no well-defined range, may wish to resurrect the following: *scudderi*, a very hairy form occurring along the northern fringe of the range of the species; *bradleyi*, also very hairy, but without silvery pubescence, occurring in parts of California, Oregon, and Utah; *mohave*, a bright bluish or greenish form almost devoid of erect hairs on the thorax or propodeum, more or less southwestern in distribution; and *texanus*, likewise scarcely hairy, but with almost the entire body silvery-sericeous, occurring in parts of the south and southeast. It is possible that future workers may be able to find some basis for splitting this species, but they will need more evidence than is now available. For the present I choose to consider the great variability of this species as due to variations in host, as presumably this species is a social parasite of a number of different pompilid wasps.

FEMALE.—Length 10 (6.5–14) mm. Color black, the middle inner, and upper outer orbits sometimes with a very small pale spot; body rendered by the pubescence an intense deep blue, blue-violet, purplish, or blue-green; lower front and clypeus usually silvery, and sometimes more of the body; occasionally practically the entire body silvery-sericeous. Fore wings lightly to rather heavily infuscated, with a more or less evident darker marginal band; hind wings varying from hyaline with only the apex infuscated to wholly infuscated except at the extreme base. Scape hairy or not; clypeus, front, vertex, temples, and propleura with abundant dark hairs; thorax and propodeum with at least a few scattered hairs, sometimes very conspicuously hairy; front coxae and femora, at least, slightly hairy, sometimes all the coxae and femora and occasionally the tibiae and even the tarsi somewhat hairy; abdomen slightly to moderately hairy below, scarcely to moderately hairy above.

Head much broader than high, transfacial distance about 1.2 × facial distance; temples very narrow, the front not strongly convex, the head in general somewhat thinner than in the preceding 3 species. (See Fig. 25.) Clypeus about 3 × as broad as high. Front very broad, middle interocular distance varying from .60 to .65 × transfacial distance; eyes converging very slightly above. Ocelli forming a right or obtuse angle in front, postocellar line subequal to or slightly less than ocello-ocular line. Antennae short, the first 4 segments in a ratio of about 2.5 : 1 : 2 : 2.2, though somewhat variable in this respect; segment 3 not much if any more than twice as long as its greatest thickness, equal to from .3 to .45 × upper interocular distance.

Pronotum broadly arcuate behind, often, but not always, with a small angulate notch medially (Fig. 25). Propodeum with a well-defined slightly concave declivity; median line impressed in front. Front tarsus (Fig. 4) with a strong comb, the spines somewhat flattened and blade-like, often pale tipped; basitarsus with from 3 to 5 comb-spines, most often 4, the apical one about as long as the 2d tarsal segment, sometimes slightly longer or shorter.

Anal vein of hind wing sloping gradually into the media, which it reaches near the origin of the cubitus (as in *parvus*, Fig. 13). Fore wing with the marginal cell about or slightly more than its own length from the wing-tip; 2d and 3d submarginal cells subequal in breadth, or either slightly the broader; the 3d narrowed by at least two-thirds above, often nearly or quite triangular.

MALE—Length 8 (5–11) mm. Color black, the vestiture bluish, purplish, or blue-green, on the lower front and posterior slope of the propodeum almost always conspicuously silvery, the body often more extensively silvery than this. Wings hyaline or nearly so, with a narrow fuscous outer marginal band. Scape usually hairy; clypeus, front, vertex, temples, and propleura with rather dense short hairs, the front in particular more densely hairy than in *parvus*; front coxae and pronotum slightly hairy; femora and middle and hind coxae hairy or not; propodeum with at least a few black erect hairs toward the sides.

Clypeus 2.2–2.5 × as broad as high. Front broad, middle interocular distance from .60 to .64 × transfacial distance; inner orbits diverging above. Ocelli as in female. Antennae short, the first 4 segments in a ratio of about 2.5 : 1 : 1.5 : 2, segment 3 from 1 to 1.5 × as long as thick. Posterior pronotal margin arcuate or with a feeble median angulation. Slope of the propodeum low, somewhat steepened behind. Last segment of front tarsus only very slightly modified, asymmetrical, the inner claw modified as usual, the outer claw dentate. Venation as in the female.

Sternite 6 with a large, V-shaped emargination; subgenital plate not differing noticeably from that of *parvus* (Fig. 33). Genitalia (Fig. 21) with the parameres very slender; basal hooklets single, the lower sclerotized points obsolete or nearly so; digiti strongly curved apically, the portion beyond the curvature generally longer than in *parvus*, the disc clothed with numerous short setae which tend to be crowded toward the upper, outer angles; aedoeagus with numerous setae along the shaft and at the apex.

Biology.—This species has been taken on the flowers of *Pastinaca sativa, Solidago, Asclepias, Sphaeralcea angustifolia, Tamarix gallica,* and *Cleome serrulata.* It occurs especially in sandy places and clay banks along water-courses.

Recently, while studying the biology of *Anoplius americanus* (Beauvois) along the banks of the Kansas River at Manhattan, Kansas, I have been able to learn something of the manner of parasitism of *E. hyacinthinus.* One morning, over a two hour period, an *americanus* was observed constructing a tunnel in a clay bank, the spider having been deposited on the earth about a foot from the excavations. During this time a female *hyacinthinus* was observed circling about the area, seemingly rather haphazardly, but occasionally approaching the tunnel long enough, I suppose, to observe that it had not yet been completed. Finally the *americanus* returned to its spider, dragged it to the nest, and then seized it by the end of the abdomen and pulled it into the nest. Several minutes elapsed, when the *americanus* was seen down in the tunnel at some depth working the soil with her legs and apparently beginning filling operations. At this moment the *hyacinthinus* appeared suddenly on the scene, and entered the tunnel without hesitation. I expected to see it driven out immediately, but nothing of the sort occurred. Rather I observed a rapid movement of the two wasps in the tunnel, and a moment later saw the *americanus* resume her activities of filling the burrow. These actions puzzled me, and after about 5 more minutes I captured the *americanus* with my forceps, and began to dig out the nest. I discovered the tunnel to be about three inches deep, and at that time about half filled by the *americanus.* In the cell at the end, buried under an inch and a half of soil, I found the *hyacinthinus.* She was resting on top of the spider (which was ventral-side up) and was very reluctant to move, even when prodded with the forceps. Finally she was taken, and the spider carefully removed from the cell. No evidence of an egg was found on the spider, but the mouthparts of the wasp were moist with an albuminous substance which may have been the remains of the egg of the *americanus* which she destroyed. Presumably the *hyacinthinus* was about to lay an egg herself when taken, and would have dug her way out through the filled tunnel when this was completed. The surprising point to me was the fact that the *americanus* permitted the *hyacinthinus* to pass her in the tunnel, and then went on with her filling of the burrow. It would be interesting to know if this particular mode of entry is always used by *hyacinthinus;* I suspect it is not.

Distribution.—This species occurs in a broad band across the continent, from the Transition to the Lower Austral Zones of Canada, the United States, and Mexico.

Specimens seen: 490 (335 ♀♀, 155 ♂♂). The following records define the periphery of the range so far as present knowledge goes: NEW BRUNSWICK: 2 ♀♀, 1 ♂, St. Stephen, 16 July [CNC]; PRINCE EDWARD ISLAND: 2 ♀♀, 1 ♂, Canad. Nat. Park, 19 July [CNC]; QUEBEC: 1 ♂, St. Hyacinthe [QPM]; ONTARIO: 1 ♀, Sudbury [CNC]; WISCONSIN: 1 ♀, Rib Mt. State Park, 27 Aug. [Minn.]; MANITOBA: 1 ♀, Aweme, 12 July [CNC]; ALBERTA: 1 ♂, Edgerton, 20 June [Alta]; BRITISH COLUMBIA: 1 ♂, Creston, 1924 [CNC]; BAJA CALIFORNIA: 1 ♀, La Paz, June [CAS]; ARIZONA: Cochise Co., 1 ♂, Huachuca Mts., June [CAS]; NEW MEXICO: Otero Co., 1 ♀, 12 mi. SW. of Alamogordo, 27 July [HEE]; TEXAS: Presidio Co., 1 ♀, Marfa, 27 July [HEE]; Dimmit Co., 1 ♀, Carrizo Springs, 17 June [OSC]; LOUISIANA: St. Landry Co., 1 ♂, Opelousas [USNM]; FLORIDA: Hendry Co., 1 ♀, LaBelle, 8 April [CU].

5. **Evagetes subangulatus** (Banks) new combination

Sophropompilus subangulatus Banks, 1919, Bull. Mus. Comp. Zool., 63: 237–239. [Type: ♀; Ingleside, San Francisco, Calif., 25 Aug. 1908 (J. C. Bradley); C.U. no. 689.][80]—Strickland, 1947, Canad. Ent., 79: 124. [Edmonton, Alta.]

Psammochares (*Sophropompilus*) *tebemi* Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 127. [Type: ♀; Smokemont, N. C., 30 June 1934 (T. B. Mitchell); No. Carolina Dept. Agri., Raleigh (not seen by author).] New synonymy.—Brimley, 1938, Insects N. Carolina, p. 434.

This species is in many respects intermediate between the preceding four and the next species, *crassicornis*. The pubescence is deep metallic, almost black, by no means as brilliant as in any of the preceding forms. The pronotum is usually distinctly, though very broadly, angulate behind; the antennae are long for the genus. The male subgenital plate resembles that of *parvus* and its allies; this fact and the more hairy body and longer comb-spines of the female separate it readily from *crassicornis*. *Subangulatus* is much more widely distributed than has usually been realized.

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[80] A male paratype with the same data as the type [MCZ] does not belong to this genus, but is an *Anoplius* (*Pompilinus*) *clystera* (Banks).

FEMALE.—Length 10.5 (7.5–13) mm. Color black, upper outer orbits often with a very small pale spot; pubescence very dark, rather obscurely reflecting deep bluish or purplish, nowhere silvery. Fore wings lightly to heavily infuscated, with a darker marginal band; hind wings subhyaline, the apex infuscated. Scape slightly hairy; clypeus, front, vertex, temples, and propleura with considerable short, dark hair; front coxae, pronotum, propodeum, and first abdominal tergite very noticeably hairy; mesonotum, scutellum, mesopleura, middle and hind coxae usually slightly hairy, sometimes also the femora.

Head broad, transfacial distance about 1.2 × facial distance. Clypeus 3 × as broad as high. Front broad, middle interocular distance varying from .60 to .64 × transfacial distance; inner orbits converging slightly above. Ocelli forming a right or obtuse angle in front, post-ocellar line is to ocello-ocular line about as 4 : 5. Antennae of moderate length, and more slender than in the preceding four species, the flagellum only a little thickened toward the middle; first 4 segments in a ratio of about 5 : 2 : 5 : 5, the 3d segment sometimes slightly longer than 1 or 4, equal to slightly less than half the upper interocular distance. Temples very narrow; front not strongly convex.

Pronotum rather long, the slope abrupt in front, nearly flat behind; posterior margin broadly angulate or subangulate. Propodeum with the median line strongly impressed, the declivity oblique and slightly concave. Front tarsus with a comb of long, slender, slightly flattened spines, sometimes pale-tipped; basitarsus with either 3 or 4 comb-spines, the apical one as long as, often longer than, the 2d tarsal segment (Fig. 5). Venation not differing notably from that of *hyacinthinus*, except that the 3d submarginal cell is rarely triangular.

MALE.—Length 9 (5.5–12) mm. Black, pubescence as in the female, never even in small part silvery. Wings varying from hyaline to moderately infuscated, with a darker marginal band. Scape hairy below; clypeus, front, vertex, temples, and propleura rather densely hairy; front coxae, pronotum, propodeum, and anterior slope of tergite 1 with rather abundant erect hairs; remainder of thorax, coxae, and venter with sparse, short hairs.

Clypeus about 2.5 × as broad as high. Middle interocular distance varying from .60 to .67 × transfacial distance; eyes diverging very slightly above. Post-ocellar line subequal to or slightly less than ocello-ocular line. First 4 antennal segments in a ratio of about 2.2 : 1 : 1.8 : 2, segment 3 about 1.5 × as long as thick (Fig. 35). Pronotum as in female. Propodeum with the median line impressed in front, the declivity short and abrupt. Last segment of front tarsus rather strongly produced on the inner margin; outer claw of front tarsus bifid.

Sternite 6 with the emargination large, V-shaped. Subgenital plate virtually the same as in *parvus*, shown in Fig. 33. Genitalia (Fig. 23) quite distinctive; parameres straight, tapering to an acute apex, not strongly setose; digiti subclavate, sparsely clothed with setae; basal hooklets double; aedoeagus usually the longest of the appendages, the shaft with a few small setae, the apex feebly bilobed.

Biology.—This species occurs either in open country or in clearings in woodlands, and like its congeners is partial to sandy soil. There are several records of its having been taken on *Solidago* blossoms, and one on *Spiraea.*

Distribution.—This species occurs transcontinentally from the Hudsonian to the Transition Zones, from Labrador and Yukon to Georgia in the Appalachians and to New Mexico, Arizona, and California in the mountains of the West.

Specimens seen: 159 (85 ♀♀, 74 ♂♂). The following records are marginal: NOVA SCOTIA: 1 ♀, Kings Co., 21 June [CNC]; LABRADOR: 1 ♀, Goose Bay, 14 Aug. [CNC]; ONTARIO: 1 ♀, Sudbury [CNC]; MICHIGAN: Midland Co., 1 ♀, 1 ♂, May, Sept. [MCZ]; MINNESOTA: Clearwater Co., 1 ♀, 2 ♂♂, Itasca Park, July–Sept. [Minn.]; MANITOBA: 3 ♀♀, Aweme, June, Aug. [CNC]; ALBERTA: 1 ♂, Edmonton, June [Alta.]; YUKON: 2 ♀♀, Whitehorse, June, July [CNC, CAS]; BRITISH COLUMBIA: 2 ♂♂, Victoria, 14 July [CNC]; CALIFORNIA: Tulare Co., 1 ♂, Giant Forest, Sequoia Nat. Park, 21 July [MCZ]; ARIZONA: Cochise Co., 1 ♀, Rustler's Park, Chiricahua Mts., 9000 ft., 7–8 Aug. [HEE]; NEW MEXICO: Otero Co., 3 ♀♀, 1 ♂, Cloudcroft, 18 June, 26 July [HEE, ANSP]; COLORADO: Boulder Co., 1 ♂, Boulder, Aug. [MCZ]; SOUTH DAKOTA: Scully Co., 1 ♀, Onida, 21 June [SDS]; MINNESOTA: Hennepin Co., 1 ♀, Lake Minnetonka, 26 June [Minn.]; OHIO: Franklin Co., 1 ♀, Columbus [USNM]; GEORGIA: Dawson Co., 1 ♀, July [EU]; NORTH CAROLINA: Buncombe Co., 5 ♂♂, Black Mt., 14–28 Aug. [AMNH]; NEW JERSEY: Gloucester Co., 1 ♂, Wenonah, 14 May [ANSP].

6a. Evagetes crassicornis crassicornis (Shuckard) new combination[31]

(Plate X, fig. 8; plate XII, fig. 22; plate XIII, figs. 26, 32.)

Pompilus crassicornis Shuckard, 1835, Essay Indig. Fossor. Hymen., p. 63. [Described from ♀♀ from several places in England; location of types, if extant, not known to me.]—Richards and Hamm, 1939, Trans. Soc. Brit. Ent., 6: 88. [Biology.]

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[31] I have not attempted to present a complete list of synonyms and references for this Holarctic species pertaining to the European fauna. The reader is referred to Haupt (1927) and Wilcke (1943) for synonymy, and to Richards and Hamm (1939) for references on the biology of the species.

Pompilus pectinipes var. 2 ♀ *campestris* Wesmael, 1851, Bull. Acad. Belg., 18: 466. [Described from a ♀ from Belgium; location of type unknown to me.]

Pompiloides rufibasis Banks, 1911, Jour. N. Y. Ent. Soc. 19: 226. [Type: ♀; Ithaca, N. Y., 1-7 July (Banks); Mus. Comp. Zool., no. 13,702.] New synonymy.

Pompiloides (*Nanopompilus*) *rufibasis* Banks, 1914, Jour. N. Y. Ent. Soc., 22: 301.

Psammochares (*Nannopompilus*) *rufibasis* Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 988.

Nannopompilus rufibasis Banks, 1919, Bull. Mus. Comp. Zool., 63: 237. [Olympia, Wash.]

Psammochares (*Psammochares*) *campestris* Haupt, 1927, Deutsch. Ent. Zeitschr., Beiheft, p. 218.

Sophropompilus crassicornis Wilcke, 1943, Med. van de Landbouwhoogeschool Wageningen, 47: 62, 68.

Sophropompilus rufibasis Strickland, 1947, Canad. Ent., 79: 124. [Edmonton, Alta.]

This easily recognizable form is the most northerly in distribution of the American *Evagetes*. The Nearctic *rufibasis* Banks has been placed in synonymy with the Palaearctic *crassicornis* Shuckard after a careful study of Wilcke's (1943) description and figures, and of a series of specimens from Holland sent to me by Dr. P. M. F. Verhoeff and determined by him as this species. In all respects, including the male genitalia, the American and European specimens resemble each other very closely.

FEMALE.—Length 8 5 (6-11) mm. Color black, the abdomen marked with at least a little rufous near the base, usually with the greater part of the basal 2 or 3 segments rufous above and below. Wings hyaline or lightly infuscated, the outer margin with a fuscous band. Pubescence brownish, usually varied with silvery on at least the lower front, coxae, and base of abdomen, sometimes extensively silvery. Clypeus, front, and vertex with short hairs in moderate abundance; temples and propleura rather hairy; front coxae slightly setose in front and behind; remainder of thorax, and the propodeum, with at most a few scattered, inconspicuous short hairs.

Clypeus about 3 × as broad as high. Front broad, middle interocular distance varying from .60 to .67 × transfacial distance; inner orbits converging slightly above, upper interocular distance from .8 to .9 × the lower. Antennae rather long for the genus, the flagellum only slightly thickened and flattened toward the middle; first 4 segments in a ratio of about

2.5 : 1 : 2.7 : 2.5, segment 3 about 2.5 × as long as thick and equal to from .45 to .6 × upper interocular distance. Ocelli in approximately a right triangle, post-ocellar line and ocello-ocular line subequal, or either may be slightly the greater. (Dorsal view of head and pronotum shown in Fig. 26.)

Posterior margin of pronotum more or less broadly angulate, though not always as distinctly so as the specimen figured (Fig. 26). Propodeum with the median line impressed in front, the declivity rather well defined, oblique. Front tarsus with a comb of slender, fairly long spines; basitarsus with 3, rarely 4, comb-spines, the one at the apex of the segment equal to from three-fourths to one and one-fourth × the 2d tarsal segment.

Fore wing with the marginal cell rather small, from 1.2 to 1.6 × its own length from the wing-tip, the radial vein arcuate or slightly angled at the 3d transverse cubital vein. Submarginal cells rather variable in shape; 2d submarginal cell narrowed somewhat above; 3d narrowed strongly above, sometimes triangular, occasionally petiolate. 2d transverse cubital vein somewhat oblique.

MALE.—Length 7 (5–9) mm. Color black, with at least a small amount of rufous on tergite 2, at most with the basal two abdominal segments and the base of tergite 3 wholly rufous. Wings hyaline or nearly so, with a narrow fuscous band along the outer margin. Pubescence over a considerable part of the head, thorax, propodeum, and usually the base of the abdomen silvery, elsewhere brownish. Scape slightly hairy or not; clypeus, front, vertex, temples, and propleura with considerable short, dark hair; front coxae, pronotum, abdominal venter, and sometimes the sides of the propodeum sparsely short-haired.

Clypeus 2.3–2.6 × as broad as high. Front rather broad; inner orbits subparallel or diverging slightly above. Post-ocellar line subequal to or slightly greater or less than ocello-ocular line; ocelli in about a right triangle. First 4 antennal segments in a ratio of about 2 : 1 : 1.7 : 1.9, segment 3 from 1.5 to 2 × as long as thick. Posterior pronotal margin broadly angulate. Median line of propodeum strongly impressed. Last segment of front tarsus rather strongly produced on the inner margin, the inner claw strongly modified, the outer claw bifid (Fig. 8). Venation as in the female.

Sternite 6 with a broad, shallow emargination. Subgenital plate (Fig. 32) distinctive, provided with two strong but short, subparallel carinae near the base, visible without dissection unless the abdomen is strongly telescoped. Genitalia (Fig. 22) also very distinctive: aedoeagus very slender, parallel-sided, with only some very minute spines at the apex; basal hooklets single; digitus apically terminating in a large nasutiform lobe; disc of digitus clothed with short hairs which are longer and directed mesad along the inner margin.

Biology.—This species is known to be a social parasite of several Pompilini. Its habits are discussed under the generic heading;

the reader is also referred to Richards and Hamm (1939) and to the references cited in that paper. In North America its habits have not been observed. The species inhabits sandy or gravelly areas, often in the vicinity of woods.

Distribution.—Holarctic. In Europe the species is widely distributed throughout the northern part of the continent; in North America it occurs across the continent in the Hudsonian and Canadian Zones, and to a limited extent the Transition Zone, although it appears to extend no farther south in the Appalachians than Pennsylvania, and no farther south in the mountains of the West than Washington and Alberta.

Specimens seen (Nearctic): 110 (99 ♀♀, 11 ♂♂). Marginal records are as follows: NOVA SCOTIA: 1 ♂, Kentville, 21 July [CNC]; NEW BRUNSWICK: 1 ♀, Fredericton, 15 June [CNC]; QUEBEC: 1 ♀, Kazabazua, 9 Aug. [CNC]; ONTARIO: 2 ♀♀, Sudbury [CNC]; MANITOBA: 1 ♀, Aweme, 24 Aug [CNC]; NORTHWEST TERRITORIES. 9 ♀♀, 1 ♂, Reindeer Depot, McKenzie Delta, 13 Aug. [CNC]; YUKON: 3 ♀♀, 1 ♂, Whitehorse, 3-4 July [CNC]; 2 ♀♀, Snag, 24 July [CNC]; BRITISH COLUMBIA: 1 ♂, Fort Nelson, 10 June [CNC]; WASHINGTON: Jefferson Co., 1 ♀, Olympus Nat. Park, 5000 feet, Aug. [CIS]; ALBERTA: 2 ♀♀, Bilby, July, Aug [Alta.]; MINNESOTA: Scott Co., 1 ♀, 6 June [Minn.]; WISCONSIN: 1 ♀, Rib Mt. State Park, 27 Aug. [Minn.]; MICHIGAN: Baraga Co., 1 ♀, 5 Sept. [ANSP]; NEW YORK: Chautauqua Co., 1 ♀, Bemus Point, 12 Aug. [CU]; PENNSYLVANIA: Sullivan Co., 1 ♀, Lopez, 4-15 Aug. [ANSP]; CONNECTICUT: Litchfield Co., 2 ♀♀, Colebrook, 24 Aug. [MCZ].

6b. **Evagetes crassicornis consimilis** (Banks) new combination

Pompiloides consimilis Banks, 1911, Jour. N. Y. Ent. Soc., 19: 228. [Type. ♀; Florissant, Colo., on sand, 12 June 1908 (S A. Rohwer); U.S N.M. no. 20,120.] [32]

Pompiloides (Nanopompilus) consimilis Banks, 1914, Jour. N. Y. Ent. Soc., 22: 301.

Psammochares (Nannopompilus) consimilis Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.

Nannopompilus consimilis Banks, 1919, Bull. Mus. Comp. Zool., 63: 237. [Wash., Ore.]

Sophropompilus consimilis Strickland, 1947, Canad. Ent., 79: 124. [Medicine Hat, Alta.]

This subspecies differs from typical *crassicornis* only in being wholly black and of a slightly smaller average size. In general it occurs farther south or at lower altitudes than typical *crassicornis*, although there is a considerable area where both may occur. It is interesting to note that this species parallels almost exactly the case of *Pompilus fumipennis* Zetterstedt, which is also Holarctic and which also has a subspecies occupying about the same range as *consimilis* and differing in the same characters from the typical form.

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[32] Ten paratypes [USNM and MCZ] are in part this form and in part two species of *Pompilus*.

FEMALE.—Length 7.5 (5–9) mm Color black; wings hyaline or lightly infuscated, with a fuscous band along the outer margin. Pubescence brownish, usually varied with silvery on the lower front, clypeus, and more or less of the coxae and lower thoracic pleura and propodeum. Posterior pronotal margin broadly angulate or occasionally practically arcuate. Marginal cell of fore wing small, nearly twice its own length from the wing-tip; 2d and 3d submarginal cells small, the 3d usually nearly or quite triangular, sometimes petiolate

MALE.—Length 6.5 (5–8) mm. Color black, without a trace of rufous on the abdomen; wings hyaline, with a rather broad, lightly infuscated band along the outer margin. Pubescence brownish and silvery in varying proportions; head and prothorax with a small amount of short hair, the remainder of the body practically devoid of hair Posterior pronotal margin broadly angulate or nearly arcuate; venation as in female. Terminalia as described under the typical subspecies. The male of this form is very similar to several species of *Pompilus*, subgenus *Ammosphex*, but the subgenital plate is so characteristic as to identify it at once.

Biology.—This form has been collected on sand and on the flowers of *Cleome serrulata.*

Distribution.—Canadian and Transition faunas of western United States and Canada. In general occurs south of the range of typical *crassicornis*, but there is considerable overlap in range.

Specimens seen: 40 (28 ♀♀, 12 ♂♂). MANITOBA: 1 ♀, Aweme, 5 June [CNC]; SASKATCHEWAN: 1 ♂, Cut Knife, 7 June [CNC]; ALBERTA: 4 ♀♀, Medicine Hat, June–Aug. [Alta., CNC]; 1 ♂, Waterton Lake, 19 June [CNC]; 1 ♂, Strathmore, July [Alta.]; 1 ♀, Edmonton, 16 Aug. [MCZ]; 1 ♀, Wabamun, 28 June [MCZ]; YUKON: 2 ♀♀, Whitehorse, 4–5 July [CNC]; BRITISH COLUMBIA: 1 ♀, Chilcotin, 16 June [CNC]; OREGON: Grant Co., 1 ♂, Onion Creek, 7700 feet, 18 July [OSC]; Hood River Co., 1 ♂, Mt. Hood [CU]; CALIFORNIA: Eldorado Co., 1 ♀, Fallen Leaf Lake, July [CAS]; Sierra Co., 1 ♀, 1 ♂, Gold Lake, July [CAS]; NEVADA: Washoe Co., 1 ♀, Reno, May [CIS]; UTAH: Kane Co., 1 ♀, 10 mi. N. of Orderville, 14 Aug. [HEE]; NEW MEXICO: Otero Co., 2 ♀♀, 1 ♂, Cloudcroft, June–July, 9000 feet [HEE, UK]; COLORADO: 2 ♀♀ [USNM]; Boulder Co., 1 ♂, Boulder, 1 June [USNM]; Teller

Co., 4 ♀♀, 2 ♂♂, Florissant, June [USNM, MCZ]; WYOMING: 1 ♀, Mt. Adams, 3 Aug. [USNM]; Laramie Co., 4 ♀♀, 28 mi. E. of Laramie, 7700 feet, 6 Aug. [OSC, MCZ]; Yellowstone Nat. Park, 1 ♀, Sylvan Pass, 21 Aug. [Minn.]; NORTH DAKOTA: Cass Co., 1 ♂, Tower City, 19 June [USNM]; Golden Valley Co, 1 ♂, Beach [USNM].

IV. Genus **AGENIOIDEUS** Ashmead[83]

Agenioideus Ashmead, 1902, Canad. Ent., 34: 85. [Type: *Pompilus humilis* Cresson, 1867; monobasic.]

Aporoideus Ashmead, 1902, Canad. Ent., 34: 86. [Type: *Pompilus sericeus* Van der Linden, 1827; monobasic.] New synonymy.

Sericopompilus Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229. [In part.]—Sustera, 1913, Verh. zool.-bot. Ges. Wien, 62: 182, 208. [Type stated to be *Pompilus sericeus* Van der Linden; *nec Sericopompilus* Howard, 1901.]

Agenoideus Banks, 1917, Bull. Mus. Comp. Zool, 61: 107. [*Lapsus calami* for *Agenioideus* Ashmead.]

This genus shows certain structural similarities to the preceding, such as the greatly reduced pulvillar comb and the presence of setae (sometimes) on the male aedoeagus. It is appropriately named Agenia-like, for its members suggest in many ways the species of the old genus *Agenia* (tribe Auplopodini) in the Pepsinae. It is possible that there is a fundamental linkage of the two major subfamilies of the Pompilidae at this point; however, a great deal more work must yet be done on the classification of the family before such phylogenetic speculations are truly in order.

Some of the facts which suggest the possible primitive nature of this genus and its affinities with the Pepsinae are as follows: (1) the delicate build of the body and long, slender, not strongly spinose legs, suggesting certain Auplopodini; (2) the pulvillar comb consists of only a few weak setulae, the common condition in the Pepsinae, but characteristic of only a few somewhat primitive Pompilinae; (3) the "pocket" at the base of the third discoidal cell is often scarcely evident; (4) here alone among the Pompilini is the propodeum often transversely rugulose, a common condition in the Pepsinae; (5) in some species there is present in the female a slight transverse concavity on the second abdominal sternite, vaguely suggesting the transverse groove of the Pepsinae; (6) there is much variation in the development of the tarsal comb, and in one subgenus it is lacking, suggesting a possible origin in this genus of this typically pompiline character; (7) the members of this genus are typical hunters of spiders, those without the tarsal comb utilizing any convenient niche as a nest, much as in *Priocnemis*, for example; (8) the genus is protean and cosmopolitan, being represented in every zoogeographic region of the world by a highly variable assemblage of forms.

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[83] For full synonymy, see also the several subgenera.

Generic characters.—Small wasps, 4 to 17 mm. in length. Color generally black, but with a tendency toward pale markings; our species all with the apical abdominal tergite of the male white; exotic species sometimes in part ferruginous. Pubescence variable, never more than obscurely bluish-refulgent. Body almost devoid of erect hairs, though there may be some fine hair on the head, prothorax, propodeum, and apical abdominal segments.

Mandibles unidentate, in some females bidentate. Labrum notched apically, but usually completely covered by the clypeus. Front without prominences, narrow or of moderate breadth, the eyes in the female distinctly converging above. Antennae of female very slender, segment 3 considerably longer than 1 or 4, and in our species always longer than upper interocular distance.

Pronotum short, in the female somewhat swollen dorsolaterally, sometimes with a faint median impression. Postnotum at least one-third the length of the metanotum, more or less pitted and constricted opposite the spiracles, finely transversely striate. Propodeum sloping gradually, never with a well-defined declivity, often with a shallow groove running caudad from the spiracles; propodeum usually either transversely rugulose or with coarse, suberect, silvery pubescence. Legs very slender, not strongly spinose; tarsi very slender, becoming increasingly so apically. Claws of female and all but the inner front claws of the male dentate; the latter are strongly curved and bifid. Last segment of front tarsus of male parallel-sided, not produced on the inner margin. Pulvillar pad very small, the comb of about 7 weak, diverging setulae (Fig. 36).

Hind wing with the anal lobe small; cubitus arising beyond the apex of the submedian cell. Fore wing with the stigma large, at least 2.5 × as long as high, longer than the first abscissa of the radius, generally rather heavily pigmented. Marginal cell long, acute apically, usually less than its own length from the wing-tip. 2d and 3d submarginal cells both 4-sided. 3d discoidal cell long; 2d recurrent vein arising considerably more than half way from the base of the subdiscoidal vein to the margin of the wing, the latter vein nearly or quite attaining the margin of the wing. (Wing of genotype shown in Fig. 58.)

Apical abdominal segments showing considerable tendency to telescope in both sexes, but especially in the males, so that the abdomen appears rather short in resting position. Male genitalia with the basal hooklets single; parameres long, not much if any widened apically; digiti more or less expanded apically, the disc clothed sparsely with minute, simple hairs;

parapenials simple, slender; aedoeagus sometimes with minute setae along the shaft.

Biology.—The meager information available regarding the biology of these forms is summarized under the several subgenera. In general, they are hunters of spiders, and apparently not highly selective of their prey. They nest in the ground or in niches of various sorts, and seem especially attracted to walls, cliffs, and buildings. All three of our species have occasionally been taken inside buildings. They appear to visit flowers only occasionally.

Distribution.—Cosmopolitan; poorly represented in the New World. The genus is here divided into three subgenera, each containing a single species; many of the exotic species can be placed in these subgenera, but by no means all of them.

Key to Subgenera

1. Female: Apical tarsal segments with several median spines in a row beneath; tarsal comb well developed; propodeum transversely rugulose (sometimes only feebly). ♂ : subgenital plate not compressed or keeled, nearly flat; parameres of genitalia very slender, slightly curved, short-setose .... A. **Ridestus** Banks

   Female: Apical tarsal segments not or very feebly spinose beneath; tarsal comb present or absent; propodeum smooth or slightly rugulose. ♂ : subgenital plate compressed, strongly keeled; parameres somewhat elbowed about midway 2

2. Legs moderately spinose, the longer spines of the hind tibia about half as long as the thickness of the tibia at their base. ♀ : Tarsal comb well developed. ♂ : Aedoeagus constricted just before the apex, which is in the form of two slender lobes. (♂ ♂ of our species, and often the ♀ ♀, with a white spot on the hind tibia) B. **Agenioideus** Ashmead

   Legs weakly spinose, the spines on the hind tibia not half as long as the width of the tibia at their base. ♀ : Tarsal comb wanting. ♂ : Aedoeagus simple, not constricted subapically. (Our species without a white spot on the hind tibia.) ....C. **Gymnochares** Banks

A. Subgenus **RIDESTUS** Banks

Ridestus Banks, 1912, Jour. N. Y. Ent. Soc., 19: *223*. [Type: *Psammochares transversalis* Banks, 1910 (= *biedermani* Banks, 1910); original designation.]—Dreisbach, 1949, Ent. Amer., (n.s.) 29: 5.

Rhidestus Gussakovskij, 1929, Rev. Russe Ent., 23: 5. [*Lapsus calami* for *Ridestus* Banks.]

Subgeneric characters.—Apical margin of clypeus of male truncate or rounded, of female slightly notched medially. Malar space very narrow. Head slightly thicker than in the typical subgenus, the temples in the female somewhat more strongly developed. Propodeum in the female obscurely to rather strongly transversely rugulose, and without erect hairs or silvery pubescence; propodeum of male covered with coarse silvery pubescence which diverges from the median line. Front tarsus of female with a comb of long, slender spines; apical tarsal segments in this sex with a row of small spines beneath, sometimes present but very minute in the male. Legs very slender, especially apically; claws rather long and bent only slightly. Apical abdominal segments of the male tending to telescope into the first three; apex of abdomen not noticeably compressed. Subgenital plate of moderate breadth, nearly flat. Genitalia with the parameres very slender, curved only slightly; aedoeagus simple, without spines or setae.

Biology.—Available evidence indicates that the species of this subgenus nest in crevices among rocks or in walls, including the foundations of houses. There are no host records.

Distribution.—This subgenus is represented in this hemisphere only by the genotype. Certain Old World species, such as *cliens* Kohl and *excisus* Morawitz, appear to go here on the basis of the females, but I have not seen males of these species and hence cannot assign them definitely.

1. **Agenioideus (Ridestus) biedermani** (Banks) new combination
(Plate XIII, fig. 36; plate XIV, fig. 40.)

Psammochares biedermani Banks, 1910 (June), Jour. N. Y. Ent. Soc, 18: 116. [Type: ♂; Palmerlee, Ariz., July (Biederman); M.C.Z no. 13,706.]

Psammochares striatulus Banks, 1910 (June), Jour. N. Y. Ent. Soc., 18: 119. [Type: ♀; Palmerlee, Ariz., Aug. (Biederman); M.C.Z. no. 13,662.] New synonymy.

Psammochares transversalis Banks, 1910 (Dec.), Psyche, 17: 248. [Type· ♀; Palmerlee, Ariz., Aug. (Biederman); M.C.Z. no. 13,661.] New synonymy.

Ridestus transversalis Banks, 1911, Jour. N. Y. Ent. Soc., 19: 223. [Made genotype of n. gen. *Ridestus*.]

Sericopompilus biedermani Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229.

Psammochares (Gymnochares) biedermani Banks, 1917, Bull. Mus. Comp. Zool., 61: 108.

Gymnochares biedermani Banks, 1919, Bull. Mus. Comp. Zool., 63: 239. [Claremont, Calif.]

Gymnochares biedermanni [*sic*] Dreisbach, 1949, Ent. Amer., (n.s.) 29: 40, pl. IV, fig. 18.

The males of this species are easily confused with those of *A.* (*Gymnochares*) *birkmanni* Banks, since in both the abdomen is usually more or less telescoped and the apical segments difficult to observe. A convenient character for separating them is the fact that the third antennal segment in *biedermani* is about 3 × as long as thick and as long as the fourth; in *birkmanni* it is about twice as long as thick and slightly shorter than the fourth. The females of these two species have considerable superficial resemblance, although the subgeneric differences readily separate them on close inspection.

FEMALE.—Length 12 (7–17) mm. Color black, the middle inner and upper outer orbits each with a small pale spot; fore wings lightly to rather heavily infuscated, a little darker along the outer margin; hind wings hyaline, the apex infuscated. Body clothed with a fine brownish pubescence, except on the sides of the lower front, where it is silvery. Front, vertex, and front coxae with a few erect hairs; temples and propleura with dense, fine hair; apical abdominal segments with a few setae; remainder of body virtually devoid of hair

Mandibles with two strong teeth on the inner margin. Clypeus about 2.5 × as broad as high, a little broader than the lower front, its apical margin with a distinct but shallow median notch. Base of mandibles practically touching the bottoms of the eyes. Front narrow, middle interocular distance from .52 to .58 × transfacial distance; inner orbits nearly parallel below, distinctly convergent above, upper interocular distance from .75 to .8 × lower interocular distance. Ocelli forming about a right triangle, post-ocellar line is to ocello-ocular line usually about as 3:2. Antennae very long and slender, the first 4 segments in a ratio of about 3:1:6:4, segment 3 equal to from 1.2 to 1.7 × upper interocular distance. Temples slightly developed, the head arcuately contracted almost immediately behind the eyes.

Pronotum short, somewhat impressed medially, rather full in the shoulders, the posterior margin subarcuate. Postnotum about half the length of the metanotum. Posterior slope of the propodeum with a series of transverse rugae, varying from barely perceptible to fairly strong. Front basitarsus with 3 very slender comb-spines, the apical one about as long as the 2d tarsal segment. Fore wing with the marginal cell about two-thirds its own length from the wing-tip, the radial vein arcuate. Second submarginal cell narrowed by usually about one-third above, the 3d submarginal cell narrowed by about half above, this cell generally somewhat larger than in *humilis*. Stigma very large, longer than the transverse median vein. Subdiscoidal vein ending a short distance from the wing margin. Abdomen with sternite 2 slightly concave in profile.

MALE.—Length 7.5 (5.5–11) mm.; fore wing longer than the body length when the abdomen is telescoped, as it normally is in resting position. Color black, the inner and outer orbits usually with a small, inconspicuous pale spot, the apical abdominal tergite mostly white. Wings clear hyaline, the apical margin of the fore wing and sometimes the tip of the hind wing narrowly infuscated. Practically the entire body silvery-sericeous, the pubescence on the propodeum rather coarse, diverging from the median line. Front and vertex very slightly hairy; temples and propleura with considerable white erect hair, the pronotum and front coxae with a little.

Clypeus about 1.5–1.7 × as broad as high, the apical margin subtruncate or somewhat rounded, the disc rather convex. Front not very broad, middle interocular distance .57 to .6 × transfacial distance; inner orbits nearly parallel. Ocelli large, in approximately a right triangle; post-ocellar line is to ocello-ocular line about as 3:2. Antennae slender, of moderate length, the first 4 segments in a ratio of about 5:2:5:5, segment 3 about 3 × as long as thick, or slightly more.

Pronotum short, its posterior margin subarcuate. Postnotum slightly shorter than the metanotum. Propodeum without rugae, the slope low and even, the median line faintly indicated. Longer spur of hind tibia slightly over half the length of the basitarsus. Legs but weakly spinose. Venation as in the female.

Abdomen with the first 3 segments rather long, forming a slight arch, in resting position the remaining segments more or less telescoped into these three. Apical segments scarcely compressed. Subgenital plate broadly subspatulate, the apex rounded, its margin short-setose; median line of plate only very slightly elevated. Genitalia (Fig. 40) with the parameres very slender, more slender than the parapenials, slightly curved, short-setose; digiti rather slender, clothed with sparse hairs of moderate length; parapenials and aedoeagus about as long as the parameres, simple.

Biology.—This species is frequently taken in and around houses, and probably nests in niches in the foundations, and probably also, in the wild, in crevices in cliffs and among rocks. One specimen, a female, has been taken on goldenrod, *Solidago*. Judging from the records, there may well be two generations a year, one in late spring and early summer, another in late summer and autumn.

Distribution.—Lower Sonoran fauna, entering the Upper Sonoran to a limited extent, from Kansas, Utah, and California south into Mexico. A single specimen labeled "Montana" may represent a stray or mislabeled specimen; at least its occurrence in this state needs confirmation.

Specimens seen: 66 (43 ♀♀, 23 ♂♂). The following records are marginal so far as present records indicate: TEXAS: Brazos Co., 5 ♀♀, College Station, May, Oct. [JEG, RWS]; Dallas Co., 1 ♀, Dallas, 13 June, on porch [HEE]; KANSAS: Riley Co., 6 ♀♀, 3 ♂♂, Manhattan, June, Sept., on porch [KSC, coll. J. B. Kring]; MONTANA: 1 ♀ (no further data) [ANSP]; NEW MEXICO: San Miguel Co., 1 ♂, Beulah, 2 June [ANSP]; UTAH: Davis Co., 1 ♂, Farmington, June [UAC]; Tooele Co., 1 ♂, Skull Valley, 4 Aug. 1931 [UAC]; NEVADA: Lincoln Co., 1 ♂, Oak Springs, 25 May [UAC]; Lyon Co., 1 ♂, Yerington, 24 July [CU]; CALIFORNIA: Los Angeles Co., 1 ♀, Los Angeles [USNM]; MEXICO: Baja California: 1 ♀, La Paz, 5 June [CAS]; Chihuahua: 1 ♀, Tinaja [USNM]; Nuevo Leon: 1 ♀, Galeana, 5–6000 feet, 3 Aug. [USNM].

B. Subgenus **AGENIOIDEUS** Ashmead

Agenioideus Ashmead, 1902, Canad. Ent., 34: 85. [Type: *Pompilus humilis* Cresson, 1867; monobasic.]—Dreisbach, 1949, Ent. Amer., (n.s)29: 9, 38, pl. III, fig. 13.

Aporoideus Ashmead, 1902, Canad. Ent., 34: 86. [Type: *Pompilus sericeus* Van der Linden, 1827; monobasic.]

Agenoideus Banks, 1917, Bull. Mus. Comp. Zool., 61: 107. [*Lapsus calami* for *Agenioideus* Ashmead.]

Subgeneric characters.—Clypeus about as wide as the lower front, not emarginate apically. Malar space of variable length, in our species about half as long as the antennal pedicel. Head thin, flattened immediately behind the eyes. Propodeum with the slope low and even, with a suggestion of grooves running caudad from the spiracles; disc somewhat shining, clothed with conspicuous silvery pubescence in both sexes, without more than a faint trace of transverse rugae. Tarsal comb consisting of 6 very slender spines, 3 on the basitarsus. Apical tarsal segments not spined beneath, or with one or two very minute, scarcely evident spines. Legs moderately spinose, the longer spines on the upper side of the hind tibia in both sexes at least half as long as the thickness of the tibia at their base Abdomen of male small, but all the segments usually evident, the apical segments not or barely telescoped into the basal ones. Apical segments of male slightly compressed; subgenital plate strongly compressed, keel-shaped. Genitalia, at least in the genotype, with the aedoeagus constricted just before the apex, which is in the form of two slender lobes, and with a few minute setae along the shaft; parameres somewhat elbowed about mid-way.

Biology.—The species of this subgenus nest in sand, gravel, or in loose earth amongst the stones of walls or cliffs, probably also in the walls of buildings. The prey is caught before the nest is constructed, and consists of small spiders of the families Epeiridae, Salticidae, and Thomisidae.

Distribution.—Holarctic, and probably more widely distributed. The European *sericeus* and our *humilis* are the only species I have seen.

1. Agenioideus (Agenioideus) humilis (Cresson)

(Plate XIII, fig. 37; plate XIV, fig. 39; plate XVI, fig. 58.)

Pompilus humilis Cresson, 1867, Trans. Amer. Ent. Soc., 1: 91. [Type: ♀; New York (no further data); A.N.S.P. no. 552.]—Dalla Torre, 1897, Cat. Hymen., VIII, p. 294.

Agenioideus humilis Ashmead, 1902, Canad. Ent., 34: 85. [Selected genotype of n. gen. *Agenioideus*.]—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 985.—Hurd, 1947, Pan-Pac. Ent., 23: 132. [Mt. Diablo, Calif.; biology.]—Dreisbach, 1949, Ent. Amer., (n.s.)29: 38, pl. III, fig. 13.

Anoplius humilis Viereck, 1906, Ent. News, 17: 304. [New Haven, Conn.]

Sericopompilus humilis Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229.—Rohwer, 1916, Conn. Geol. Nat. Hist. Survey Bull. 22, p. 632.

Psammochares (Agenoideus) humilis Banks, 1917, Bull. Mus. Comp. Zool., 61: 107.

Agenoideus humilis Banks, 1919, Bull. Mus. Comp. Zool., 63: 239. [Revelstoke, B. C.]

Psammochares (Sericopompilus) humilis Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 987.

The bifasciate wings at once separate *humilis* from all other native Pompilini, except the males of some species of *Sericopompilus,* which are easily separable on a number of other characters. This is one of the most widely distributed of all North American spider wasps, but does not seem to be common anywhere.

FEMALE.—Length 8 (5.5–10.5) mm. Color black, the inner orbits usually with a small pale spot, the hind tibia usually with a pale spot near the base on the outer side. Wings hyaline, the fore wings with a submarginal light fuscous band and a separate broader band extending from the marginal cell through the third discoidal, sometimes with a light cloud over the basal vein; hind wings with a pale band along the margin. Pubescence of at least the front, temples, lower sides of the thorax, coxae, and propodeum silvery, sometimes practically the whole body silvery-sericeous. Clypeus, front, and vertex weakly setose; temples and propleura with considerable pale hair; propodeum with a small amount of inconspicuous pale, erect hair in addition to the pubescence.

Clypeus about 2.5 × as broad as high, its apical margin subtruncate or very slightly rounded. Malar space about half the length of the antennal pedicel. Front of moderate breadth, middle interocular distance from .57 to .62 × transfacial distance. Eyes converging considerably above, upper interocular distance about .7 × the lower. Ocelli large and rather close together on the narrow vertex; post-ocellar line is to ocello-ocular line about as 3:2. Antennae very slender, the first 4 segments in a ratio of about 5:2:10:8, segment 3 equal to from 1.0 to 1.6 × upper interocular distance.

Pronotum very short, its posterior margin subarcuate, with a slight median angulation. Postnotum about as long as the metanotum. Propodeum with the median line not or but faintly impressed; in an occasional specimen very faint transverse rugae may be observed on the posterior slope. Tarsal comb-spines long and slender, the apical one on the basitarsus about as long as the 2d tarsal segment. Venation as shown in Fig. 58. Stigma very large, nearly or quite as long as the 2d submarginal cell, heavily pigmented. Marginal cell about three-fourths its own length from the wing-tip, pointed apically. Third submarginal cell nearly always shorter than the 2d, and usually narrowed by more than half above.

MALE.—Length 6.5 (4–9.5) mm. - Color black, the apical abdominal tergite whitish, the hind tibia with a whitish spot or streak on the outer side near the base, the inner orbits usually with a very small pale spot. Wings hyaline and bifasciate as in the female, but the bands often rather faint. Body clothed in great part with a coarse silvery pubescence, especially conspicuous on the propodeum. Vertex, temples, prothorax, and sometimes the sides of the propodeum with some very fine, light hair.

Clypeus about twice as broad as high, its apical margin truncate. Front rather broad, middle interocular distance over .6 × transfacial distance; eyes converging slightly above, upper interocular distance about .9 × the lower. Ocelli large and prominent, in about a right triangle; post-ocellar line is to ocello-ocular line about as 3:2. Antennae slender, the first 4 segments in a ratio of about 2:1:2:1.8, segment 3 about 2.5 × as long as thick. Posterior pronotal margin arcuate or subangulate. Postnotum about as long as the metanotum. Slope of propodeum very low, the median line not well impressed. Venation as in the female; 3d transverse cubital vein often rather strongly bent about mid-way.

Abdomen slender, slightly compressed toward the apex. Subgenital plate, in ventral aspect, narrowly spatulate, the apical margin fringed with short hairs; in lateral aspect (Fig. 37) with the median line very strongly raised, its profile arched. Genitalia (Fig. 39) with the parameres slender, but broader than the parapenial lobes, more or less elbowed about mid-way (usually more so than shown in figure), the apical half with long, sinuous hairs. Digiti rather broad, the outer margins arcuate, the apex abruptly truncate, the disc clothed with very minute setae. Aedoeagus with several small setae along the shaft, the apex in the form of two slender lobes.

Biology.—Hurd (1947) reports rearing this species from cocoons found at the base of a cliff in pulverized sandstone; two of eleven cocoons were parasitized, one by a bombyliid and one by a mutillid (species not stated). Not infrequently specimens are taken inside buildings, probably having nested in the walls. A specimen from Niagara Falls, N. Y. [CM] is pinned with a young epeirid spider, possibly genus *Epeira* [det. B. J. Kastón]. A specimen from Sinai Bay, Long Island, N. Y. [AMNH] bears the note: "This wasp had captured a specimen of *Aranea pegnia* Walck. [Epeiridae] (identified by W. J. Gertsch)." The species appears to have but one generation a year, most of the records being for spring or early summer in the southern part of the range, mid-summer farther north.

Distribution.—New Brunswick, Minnesota, and British Columbia south to Florida and Guatemala, chiefly in the Transition and Upper Austral Zones. The species appears to be absent from the more arid, treeless parts of the West, but is otherwise quite generally distributed throughout its range.

Specimens seen: 113 (60 ♀♀, 53 ♂♂). The following records are marginal: NEW BRUNSWICK: 1 ♀, Fredericton [CNC]; QUEBEC: 1 ♂, Aylmer, 5 Aug. [CNC]; ONTARIO: 1 ♀, Marmora, 26 July [CNC]; WISCONSIN: Columbia Co., 1 ♀, Columbus, 12 Aug. [USNM]; MINNESOTA: Blue Earth Co., 1 ♀, 28 July [Minn.]; COLORADO: Larimer Co., 1 ♀, Estes Park, 11 Aug. [CU]; BRITISH COLUMBIA: 1 ♀, Revelstoke, Selkirk Mts., 13 July [CU]; 2 ♂♂, Vancouver, July [CNC, MCZ]; CALIFORNIA: Santa Clara Co., 1 ♀, Morgan Hill, 6 Sept. [Minn.]; MEXICO: Morelos, 1 ♀, Cuernavaca, May [USNM]; GUATEMALA: 2 ♂♂, Moca Guatalon, 1000 m., Mch.-Apr. [MCZ]; TEXAS: Williamson Co., 1 ♀, 1 ♂, Liberty Hill, 17–21 June 1936 [RWS]; FLORIDA: 1 ♀ (no further data) [USNM].

C. Subgenus **GYMNOCHARES** Banks

Gymnochares Banks, 1917, Bull. Mus. Comp. Zool., 61: 107, 108. [Type: *Psammochares birkmanni* Banks, 1910; designated by Pate, 1946.] [Described as subgenus of *Psammochares*.]—Banks, 1934, Proc. Amer. Acad. Arts and Sci., 69: 99. [Philippine species.]—Pate, 1946, Trans. Amer. Ent. Soc., 72: 88.—Dreisbach, 1949, Ent. Amer., (n.s.)29: 6, 9 [not page 40, figure 18.]

This is a widely distributed and protean subgenus, in which the legs are very weakly spinose and the tarsal comb absent. Our single species superficially resembles *A.* (*Ridestus*) *biedermani* Banks.

Subgeneric characters.—Small wasps, 3.5–11 mm. in length. Mandibles of female bidentate, or the inner tooth so much reduced that they appear unidentate. Malar space very short; temples very narrow. Propodeum either smooth and silvery-sericeous, as in *Agenioideus* in the strict sense, or transversely rugulose, as in *Ridestus*. Legs weakly spinose; spines of the hind tibia small, not half as long as the width of the tibia at their base; front tarsus of female without a comb. Apical tarsal segments without spines beneath. Abdomen of male small, the apical segments compressed and more or less telescoped into the first three. Subgenital plate strongly compressed;

sternite 6 also slightly compressed, and deeply emarginate apically. Genitalia with the aedoeagus simple, not setose, the digiti slender, the parameres more or less elbowed about mid-way and somewhat setose.

Biology.—Little is known of the biology of our species. A summary of the habits of the European *cinctellus,* a member of this group, has been given by Richards and Hamm.[34] This species nests in sandy places, in niches in walls, in rotten wood, in abandoned burrows of other wasps, and is even reported as having nested in a snail-shell. It does little digging of its own, using ready-made cavities which it afterward closes with bits of earth and debris. The list of recorded hosts consists mostly of Salticidae, with a few records of Thomisidae.

Distribution.—Very widely distributed. The European *cinctellus* Spinola and *apicalis* Van der Linden belong here. The Philippine species assigned by Banks (1934) to this group appear to belong here.

1. **Agenioideus (Gymnochares) birkmanni** (Banks) new combination (Plate XIII, fig. 38; plate XIV, fig. 41.)

Psammochares birkmanni Banks, 1910, Jour. N. Y. Ent. Soc., 18: 116. [Type: ♂; Lee Co., Texas, 16 Sept. 1905 (Birkmann); M.C.Z. no. 13,707.]

Sericopompilus birkmanni Banks, 1911, Jour. N. Y. Ent. Soc., 19: 228.

Psammochares (Gymnochares) birkmanni Banks, 1917, Bull. Mus. Comp. Zool., 61: 108.

Ridestus striatulus Banks, 1919, Bull. Mus. Comp. Zool, 63: 241. [Calif.] [Misidentification; *nec* Banks, 1910.]

Gymnochares texana Banks, 1944, Bull. Mus. Comp. Zool., 94: 170. [Type: ♀; Austin, Texas, 5 June 1900 (A. L. Melander); M.C.Z. no. 25,704.] New synonymy.

Gymnochares birkmanni Pate, 1946, Trans. Amer. Ent. Soc., 72: 88. [Selected genotype]

This is a widely distributed and rather variable species. Both sexes are easily confused with *biedermani* unless care is taken in observing the subgeneric distinctions (see also notes under that species).

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[34] Richards, O. W. and Hamm, A. H., 1939, Trans. Soc. Brit. Ent., 6: 78–79.

FEMALE.—Length 7.5 (5–11) mm. Color black; wings varying from hyaline with the outer margin infuscated, to wholly infuscated and somewhat violaceous. Pubescence very fine, silvery at least on the sides of the front, sometimes with practically the whole body silvery-sericeous; pubescence otherwise brownish, obscurely violaceous. Temples and propleura with fine hair; vertex slightly hairy; apical abdominal segments with a few dark setae.

Clypeus 2.3 to 2.6 × as broad as high, the apical margin truncate and with a narrow, shining marginal rim. Front of rather variable breadth, middle interocular distance varying from .53 to .6 × transfacial distance; front with a well-defined median line from the antennal bases to the front occllus. Inner orbits convergent above, middle interocular distance subequal to the lower, upper interocular distance .67–.77 × the lower. Vertex narrow; ocelli forming an angle in front which is distinctly less than a right angle; post-ocellar line is to ocello-ocular line about as 3 : 2. Antennae very slender, the first 4 segments in a ratio of about 5 : 2 : 8 : 6, segment 3 equal to from 1.1 to 1 6 × upper interocular distance.

Pronotum short, the shoulders rather full, the median line somewhat impressed behind; posterior margin subarcuate. Postnotum from one-third to two-thirds the length of the metanotum. Propodeum with the median line usually slightly impressed in front, the posterior slope with a series of transverse rugae, sometimes weak and difficult to observe. Front tarsus with spines of moderate length at the outer apices of segments 1–3, elsewhere with only a few very short spines. Venation of the usual pattern in the genus, but the stigma smaller than usual, only about 2.5 × as long as high, but longer than the transverse median vein. Marginal cell about or a little less than its own length from the wing-tip, the radial vein evenly arcuate. Second and 3d submarginal cells subequal in size, or the 3d slightly broader; 3d narrowed by from one-third to one-half above.

MALE.—Length 5 (3.5–6.5) mm. Black, the apical abdominal tergite mostly whitish. Wings generally clear hyaline, the outer margin of the fore wing and tip of the hind wing narrowly infuscated, or they may be wholly lightly infuscated. Body in large part silvery-sericeous, the pubescence coarse and suberect on the propodeum. Body practically without erect hairs, except fine, inconspicuous hairs on the head and prothorax.

Clypeus about or slightly less than twice as broad as high, the apical margin truncate. Front of variable breadth, middle interocular distance from .54 to .62 × transfacial distance. Inner orbits subparallel or diverging slightly above, somewhat emarginate near the middle. Ocelli forming a right or somewhat acute angle in front, post-ocellar line usually greater than ocello-ocular line. Antennae with the first 4 segments in a ratio of about 2 : 1 : 1.8 : 2, segment 3 about twice as long as thick, always a bit shorter than 4. Pronotum as in female; postnotum nearly as long as the metanotum. Propodeum with the slope very low, clothed with coarse silvery pubescence which diverges from the median line. Legs weakly spinose; longer spur of hind tibia about .7 the basitarsus. Venation about as in the female, the stigma usually larger, the marginal cell pointed apically and less than its own length from the wing-tip.

Abdomen small, the basal 3 segments fairly large, slightly arched, the remaining segments more or less telescoped into these in resting position. Sternite 6 deeply emarginate. Subgenital plate strongly compressed, the sides folded against one another; in profile, the lower margin is nearly straight, the upper margin abruptly declivous subapically, the extreme apex attenuate (Fig. 38). Genitalia (Fig. 41) with the parameres elbowed, with rather long, somewhat sinuous hairs on the apical half ventrally. Basal hooklets produced into slender processes. Digiti slender, curved, with a few scattered setae of moderate length on the disc. Parapenials straight, rather thick, slightly expanded apically. Aedoeagus simple, of moderate breadth.

Biology.—This species is often taken in the vicinity of rocks, and may nest in niches in these. The single record of its prey is a female taken by the author at New Braunfels, Texas, with a ♀ *Herpyllus vasifer* (Walck.) (Gnaphosidae) [det. B. J. Kaston]. The spider is carried in flight by the wasp. Males of this species are known to visit the flowers of *Asclepias.*

Distribution.—This form occurs across the continent, but there are only two records from east of the Mississippi. It is principally a Lower Austral form, but enters the Upper Austral in the West.

Specimens seen: 48 (27 ♀♀, 21 ♂♂). GEORGIA: Charlton Co., 1 ♀, Okefenokee Swamp, July [CU]; Dekalb Co., 1 ♀, Stone Mt., 3 Aug. [MCZ]; MISSOURI: 1 ♀, St. Louis [USNM]; KANSAS: Douglas Co., 1 ♂, Lawrence, 15 June [CM]; TEXAS: 6 ♂♂ (no further data) [ANSP, USNM]; Brazos Co., 1 ♀, 1 ♂, 30 May, 28 July [JEG]; Cameron Co., 1 ♀, 1 ♂, Brownsville [USNM]; Comal Co., 1 ♀, New Braunfels, 29 June [HEE]; Lee Co., 1 ♀, 3 ♂♂, March, Sept. [MCZ]; McLennan Co., 1 ♀, 22 July [JEG]; Travis Co., 1 ♀, Austin, 5 June [MCZ]; Webb Co., 3 ♂♂. Laredo, Sept. [JEG]; Williamson Co., 1 ♀, 29 Sept. [JEG]; 1 ♀, Liberty Hill, 23 Aug. [RWS]; Grimes Co., 1 ♀, Navasota, 22 Aug. [KVK]; ARIZONA: Pima Co., 1 ♀, Tucson, June [Univ. Ariz.]; COLORADO: Larimer Co., 2 ♀♀, Poudre Canyon, 5200 feet, 21 Aug. [HEE]; WYOMING: Sweetwater Co., 1 ♀, Green River, 2 July [AMNH]; OREGON: Wasco Co., 1 ♂, Biggs Jct., 12 July [OSC]; CALIFORNIA: 1 ♀ (no further data) [CU]; Alameda Co., 1 ♀, Niles Canyon, 9 June [CAS]; Marin Co., 1 ♂, Baltimore, 2 July [CAS]; Riverside Co., 1 ♂, Blythe, 3 Aug. [CIS]; San Diego Co., 1 ♂, La Jolla, Aug. [USNM]; Tulare Co., 1 ♂, Lindsay [USNM]; MEXICO: Baja California: 1 ♀, Mouth of Rio Santelino, 21 Sept. [CAS]; Coahuila: 1 ♀, Fuente, 12 June [CIS]; Revillagigedo Islands: 7 ♀♀, 1 ♂, Clarion Isl., 26–30 Apr. [CAS, CIS].

V. Genus **SERICOPOMPILUS** Howard

Sericopompilus Howard, 1901, The Insect Book, pl. XI, fig. 17. [Type: *Pompilus cinctipes* Cresson, 1867 (=*apicalis* Say, 1837); monobasic.] —Ashmead, 1902, Canad. Ent., 34: 82. [Proposed as a new genus.]—Banks, 1911, Jour. N. Y. Ent. Soc., 19: 223, 228.—Banks, 1917, Bull. Mus. Comp. Zool., 61: 107, 108. [Subgenus of *Psammochares*.]—Dreisbach, 1949, Ent. Amer., (n.s.)29: 6, 11, 36, pl. II, fig. 6.

This distinctive genus is related to the preceding in the slender body and appendages and in the wing venation. It is closely allied to the two following genera, with which it forms a compact and well-defined generic complex, characterized by having the cubitus of the hind wing arising before the apex of the submedian cell, the postnotum arcuately expanded on each side of the median line, and with tendencies for the front tibiae to be more spinose than usual, for the eyes of the female to be rather strongly convergent above, and for the male to be patterned with pale yellow; the male genitalia are also similar in these three genera, and the subgenital plate of the same pattern throughout. The species of *Sericopompilus* are handsome insects, with slender bodies and long appendages, and often variously colored with red and pale yellow.

The genus *Sericopompilus* is represented in the Americas by three species inhabiting the Lower and Upper Austral Zones of North America. In addition I have seen an Australian species which differs in essential characters only in the presence of a median row of spines beneath the apical tarsal segments, and is thus probably no more than subgenerically distinct from the American species. Such a discontinuous distribution suggests a primitive condition, and there is morphological evidence to support such a belief. *Sericopompilus* may well represent a remnant of the ancestral stock which split off from early Pompilini and culminated in such highly successful genera as the cosmopolitan *Episyron* and *Poecilopompilus*. While sharing the general characteristics of these genera, it lacks their specializations, and in outward appearance remains much like a *Pompilus* or an *Agenioideus*.

Generic characters.—Medium-sized wasps (7–17 mm. in length) of slender build. Color predominantly black, but often marked with rufous; males with the head, thorax, legs, and apical abdominal tergite more or less marked with pale yellow. Head, prothorax, propodeum and sometimes the mesopleura and first abdominal tergite, with a considerable amount of short, fine pile.

Head rather thin, disc-like, not wider than the thorax at its widest. Apical margin of labrum with a median notch. Mandibles of the female with two teeth along the inner margin, sometimes a weak third; those of the male with a single tooth, sometimes a weak second. Malar space extremely short. Clypeus large, its upper margin feebly sinuate. Front rather broad; inner orbits slightly to strongly convergent above in the female. Antennae elongate, segment 3 in the female at least 4 × as long as thick, in the male at least twice as long as thick. Ocelli prominent, in a rather broad triangle, the front angle greater than a right angle.

Pronotum short, steeply declivous in front. Mesonotum large, in the female strongly convex; scutellum convex, prominent. Postnotum fairly long, constricted and depressed on the median line, on each side arcuately expanded, and constricted once again in front of the spiracles (Fig. 69). Propodeum with smooth contours, its slope even, never with a distinct posterior declivity. Legs long and slender, rather strongly spinose. Front tarsus of female with a comb of rather short spines, from 1 to 2 × as long as the width of the tarsus; basitarsus always with four comb-spines. Apical tarsal segments without spines beneath in both sexes. Pulvillar pad small, the comb poorly developed, of not more than 9 weak, diverging setulae. All the claws of both sexes dentate. Last segment of front tarsus of male not modified. Anterior tibia with or without some indication of several rows of spines, some of which are on the upper surface.

Wings long and slender, exceeding the abdomen, never folded longitudinally. Veins and cells extending relatively close to the wing-margin; marginal cell long and slender, less than its own length from the wing-tip; radial vein evenly arched. Stigma very large, darkly pigmented. Second and 3d submarginal cells both large and wide above. Basal and transverse median veins of fore wing interstitial or the latter meeting the media slightly beyond the basal. Anal vein of hind wing meeting the media considerably beyond the origin of the cubitus. (Wings of the genotype shown in Fig. 59.)

Abdomen of female slender, subfusiform, with a few strong but non-bristly setae toward the apex. Male abdomen variable in shape even within a single species; in some males the first one or two segments are very slender, giving the abdomen an almost petiolate appearance; in others the first segment is expanded behind, and the abdomen of the usual shape in the tribe, although very slender throughout. Sternite 6 of male deeply emarginate; subgenital plate with the median line strongly elevated, the sides sloping from it, the apex obtusely pointed or somewhat rounded. Male genitalia with the aedoeagus simple, much exceeded by the slender parapenial lobes; basal hooklets double; digiti much broadened apically, spatulate; parameres long and slender, the squamae not prominent. Our three closely allied species show no constant differences in the male genitalia. (See Fig. 42.)

Biology.—The wasps of this genus are most frequently taken at flowers; occasionally they may be found flying over the ground in sandy or waste places. What little is known of their habits is chiefly accreditable to the Peckhams,[85] who vividly describe the behavior of *Pompilus fuscipennis* (i.e., *Sericopompilus apicalis*), which preys upon thomisid and lycosid spiders and nests in soft earth. Hartman[86] found a wasp preying upon *Dolomedes* sp. (Pisauridae) which he called *Pompilogaster fuscipennis,* and which possibly was *Sericopompilus apicalis* or *neotropicalis.* It was nesting in a hole in the side of the burrow of a small rodent.

Distribution.—Sonoran subregion of the Nearctic region. As mentioned earlier, certain Australian forms appear to be only subgenerically distinct from the American species. The species from South America and the Philippines placed by Banks in *Sericopompilus* do not belong here, but to several other genera.

Key to Species

Females

1. Eyes only moderately convergent above, upper interocular distance about .85 × the lower; 3d antennal segment equal to about .7 to .8 × upper interocular distance (Fig. 47); wholly black
1. **angustatus** (Cresson)

Eyes strongly convergent above, upper interocular distance about .75 × the lower; 3d antennal segment equal to at least .9 × upper interocular distance (Figs. 45 and 46); abdomen at least in part rufo-ferruginous ... 2

2. Clypeus evenly arcuate below; ocelli of average size, post-ocellar line usually slightly greater than ocello-ocular line (Fig. 46); apical 3 or 4 segments of abdomen black; legs wholly black ....2. **apicalis** (Say)

Extreme lower margin of clypeus truncate; ocelli large, post-ocellar line distinctly greater than ocello-ocular line (Fig. 45); abdomen entirely rufo-ferruginous, the legs usually in part so
3. **neotropicalis** (Cameron)

Males

1. Upper interocular distance equal to or greater than the lower; neck usually not marked with yellowish; abdomen never marked with rufous; wings often wholly fuscous ....1. **angustatus** (Cresson)

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[85] Peckham, G. W. and E. G., 1898, Bull. Wisc. Geol. Nat. Hist. Survey, no. 2, p. 140.

[86] Hartman, C., 1905, Bull. Univ. Texas, no. 65, p. 54.

Upper interocular distance less than lower (though sometimes only very slightly so); neck with a yellowish spot on each side; abdomen usually marked with rufous; wings in large part hyaline 2

2. Ocelli of moderate size, post-ocellar line slightly greater than ocello-ocular line (Fig. 48); middle basitarsus not ringed with pale yellow
2. **apicalis** (Say)

Ocelli unusually large and prominent, post-ocellar line much greater than ocello-ocular line (Fig. 49); middle basitarsus with a broad ring of pale yellow ....3. **neotropicalis** (Cameron)

1. **Sericopompilus angustatus** (Cresson) (Plate XV, fig. 47.)

Pompilus angustatus Cresson, 1865, Proc. Ent. Soc. Phila., 4: 452. [Type: ♀; Colorado (no further data); A.N.S.P. no. 418.]—Cresson, 1867, Trans. Amer. Ent. Soc., 1: 89.—[not] Provancher, 1882, Nat. Canad., 13: 35, 38.—[not] Provancher, 1883, Nat. Canad., 14: 35.—Dalla Torre, 1897, Cat. Hymen., VIII, p. 272.

Psammochares fulvoapicalis Banks, 1910, Jour. N. Y. Ent. Soc., 18: 117. [Type: ♀; Lee Co., Texas, 2 Sept. 1905 (Birkmann); M.C.Z. no. 13,712.] New synonymy.

Psammochares (Sericopompilus) augustatus [*sic*] Banks, 1917, Bull. Mus. Comp. Zool., 61: 108.

Psammochares (Sericopompilus) fulvoapicalis Banks, 1917, Bull. Mus. Comp. Zool., 61: 108.

Sericopompilus fumosus Banks, 1933, Psyche, 40: 5. [Type: ♂; Fountain Valley School, Colorado Springs, Colo., 12–19 July 1932; M.C Z. no. 17,050.] New synonymy.

The female of this species is easily recognized by the all-black coloration and the rather broad vertex. The males may have wholly fuscous wings or hyaline wings with the outer margins broadly fuscous, or they may be intermediate between these two strikingly different extremes. A series of nine males from Victoria, Texas [USNM], exhibits the two extremes and every gradation between them.

Female.—Length 11.5 (9–14) mm. Color black, upper outer and sometimes the middle inner orbits with a very small pale spot, apex of the abdomen, when fully extended, somewhat fulvous. Wings wholly fuliginous, somewhat iridescent. Body clothed with a fine brownish or obscurely brownish-violaceous pubescence, which is sometimes silvery on the lower front. Head, thorax, and propodeum with abundant short, fine, dark hair.

Clypeus from 2 to 2.2 × as broad as high, its apical margin rounded or very feebly truncate. Segments of the maxillary palpi somewhat shorter than in the following two species. Front broad, middle interocular distance .62–.67 × transfacial distance. Middle interocular distance from 1.05 to 1.1

× the lower, upper interocular distance from .8 to .9 × the lower, the eyes thus only moderately convergent above. Antennae of moderate length, the first 4 segments in a ratio of about 3 : 1 : 4.2 : 3, segment 3 approximately .75 × upper interocular distance. Vertex slightly, arcuately raised above the tops of the eyes; post-ocellar line usually slightly greater than ocello-ocular line. (Head shown in Fig. 47.)

Posterior pronotal margin subarcuate, with a slight median angulation. Propodeum with a rather well-defined median line. Spines of the tarsal comb nearly twice as long as the width of the tarsus. Other features, including the venation, as described under the generic heading.

MALE.—Length 9.5 (7–12) mm. Color black, the following pale yellowish: middle inner and upper outer orbits narrowly and briefly; posterior margin of pronotum rather broadly; a small spot on the axillary sclerites of the fore wing, just behind the tegulae, and sometimes a spot on the mesonotum adjacent to it; sides of the posterior rim of the propodeum; apical abdominal tergite; middle tibial spurs; broad basal rings on segments 1, 2, 3, and 4 of the middle tarsi, and on segments 2, 3, and 4 of the hind tarsi (sometimes 1 and the spurs to some extent); hind tibia with a streak on the outer side for the basal two-thirds. Wings wholly brownish, or hyaline with the outer margin broadly banded with brownish, or intermediate. Pubescence brownish-cinereous, more or less silvery on the lower front and clypeus, coxae, sides of the thorax, and propodeum, sometimes more extensively so. Head, thorax, and propodeum with a moderate amount of short, rather pale and inconspicuous, erect pile; apical abdominal segments with a few short, dark setae.

Clypeus a little more than twice as broad as high, the apical margin arcuate or feebly truncate. Front broad, middle interocular distance usually about .65 × transfacial distance; inner orbits somewhat emarginate just above the middle; upper interocular distance about equal to the lower, or slightly greater. First 4 antennal segments in a ratio of about 5 : 2 : 5 : 5, segment 3 slightly more than twice as long as thick. Ocellar triangle prominent, post-ocellar line slightly greater than ocello-ocular line.

Posterior pronotal margin subarcuate or very feebly angulate. Median line of propodeum somewhat impressed. Abdomen subfusiform, the first segment gradually expanded posteriorly, never as slender as it sometimes is in the following two species. Apical segments as described under the generic heading.

Biology.—This wasp has been taken on the flowers of *Melilotus alba, Stillingia squiraria,* and *Petalostemon oligophyllum;* it occurs throughout the warmer months of the year, from May to October.

Distribution.—This species occurs throughout the Lower and Upper Austral zones of the Great Plains region, from New Mexico, Chihuahua, and eastern Texas to Colorado, South Dakota, and Michigan. A single specimen labeled "Fla." [USNM] may be mislabeled.

Specimens seen: 51 (34 ♀♀, 17 ♂♂). MEXICO: Chihuahua, 1 ♀, Samalayuca, 24 June [AMNH]; NEW MEXICO: Eddy Co., 1 ♀, Carlsbad, 11 July [OSC]; COLORADO: 2 ♀♀ (no further data) [ANSP]; El Paso Co., 1 ♂, Colorado Springs, 12–19 July [MCZ]; Weld Co., 1 ♀, Roggen, 8 July [MCZ]; KANSAS: Cheyenne Co., 1 ♂, 1 July [UK]; Wallace Co., 1 ♂, Sharon Springs, 17 June [MCZ]; NEBRASKA: Thomas Co., 2 ♀♀, 1 ♂, Halsey, June, Aug. [USNM, Minn.]; SOUTH DAKOTA: Fall River Co., 1 ♂, Hot Springs, 9 July [MCZ]; IOWA: Woodbury Co., 4 ♀♀, Sergeant's Bluff, July–Aug. [USNM]; 5 ♀♀, 2 ♂♂, Sioux City, July–Aug. [USNM]; MICHIGAN: Midland Co., 1 ♀, 7 Sept. [MCZ]; FLORIDA: 1 ♀ (no further data) [USNM]; TEXAS: Bexar Co., 2 ♀♀, June, July [JEG]; Dimmit Co., 1 ♂, Carrizo Springs, 20 June [OSC]; Hudspeth Co., 1 ♀, McNary, 24 June [OSC]; Lee Co., 8 ♀♀, Sept.–Oct. [MCZ]; Presidio Co., 1 ♀, Marfa, 27 July [HEE]; Valverde Co., 1 ♀, Del Rio, 17 July [HEE]; Victoria Co., 3 ♀♀, 9 ♂♂, Victoria, 13–16 May [USNM].

2. **Sericopompilus apicalis** (Say)

(Plate XV, figs. 46, 48; plate XVI, figs. 59, 69.)

Ceropales apicalis Say, 1835, Boston Jour. Nat. Hist., 1: 366. [Type: ♂; Indiana (no further data); (no longer extant).]

Pompilus fuscipennis Lepeletier, 1845, Hist. Nat. Ins., Hymen., III, p. 434. [Type: ♀; Philadelphia, Pa.; (location of type not known to author).] [*Nec* Van der Linden, 1827.]—Cresson, 1867, Trans. Amer. Ent. Soc., 1: 102.—Peckham and Peckham, 1898, Bull. Wisc. Geol. Nat. Hist. Survey, no. 2, pp. 140–144. [Biology.]—Birkmann, 1899, Ent. News, 10: 244. [Lee Co., Texas.]

Pompilus sordidus F. Smith, 1855, Cat. Hymen. Brit. Mus., III, p. 160. [New name for *fuscipennis* Lepeletier, preoccupied.]—Dalla Torre, 1897, Cat. Hymen., VIII, p. 324.

Pompilus cinctipes Cresson, 1867, Trans. Amer. Ent. Soc., 1: 102. [New name for *apicalis* Say, preoccupied in the genus *Pompilus*.]—Dalla Torre, 1897, Cat. Hymen., VIII, p. 280.—Birkmann, 1899, Ent. News, 10: 244. [Lee Co., Texas.]

Sericopompilus cinctipes Howard, 1901, The Insect Book, pl. XI, fig. 17.—Ashmead, 1902, Canad. Ent., 34: 82.—Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229.—Dreisbach, 1949, Ent. Amer., (n.s.) 29: 35, pl. II, fig. 6.

[?] *Pompilogaster fuscipennis* Hartman, 1905, Bull. Univ. Texas, no. 65, p. 54. [Biology.]

Anoplius cinctipes J. Smith, 1910, Ann. Rpt. N. J. State Mus. 1909, p. 674. [N. J.]

Anoplius fuscipennis J. Smith, 1910, Ann. Rpt. N. J. State Mus. 1909, p. 674.

Psammochares fuscipennis Banks, 1911, Proc. Ent. Soc. Wash., 13: 238.

Psammochares (*Sericopompilus*) *cinctipes* Banks, 1917, Bull. Mus. Comp. Zool., 61: 108.—Brimley, 1936, J. Elisha Mitchell Sci. Soc., 52: 126.

[N. Carolina, several localities.]—Brimley, 1938, Insects N. Carolina, p. 433.

Psammochares (*Sericopompilus*) *fuscipennis* Banks, 1917, Bull. Mus. Comp. Zool., 61: 108.—Brimley, 1936, J. Elisha Mitchell Sci. Soc., 52: 126.—Brimley, 1938, Insects N. Carolina, p. 433.

Sericopompilus apicalis Pate, 1946, Trans. Amer. Ent. Soc., 72: 107, 130.

This species has seldom been called by its correct name. When Cresson in 1867 referred the species to *Pompilus*, it became necessary to rename it; his name, *cinctipes*, has generally been used for males of the species. However, I consider this species and its allies generically distinct from *Pompilus*, and that Say's name is therefore available. The females have generally gone by the name of *fuscipennis*, although *sordidus* would have been the correct name, as *fuscipennis* is a homonym. In any case there is now much evidence that *sordidus* and *apicalis* are two sexes of the same species, a possibility first suggested by Cresson in 1867.

This is the best known species of the genus and the most common in collections. Although colors are rather variable in this genus, two color characters seem to hold well for *apicalis:* the basal two or three segments of the abdomen of the female are rufous, the remainder black; the middle basitarsus of the male is wholly black or brownish.

FEMALE.—Length 13.5 (11-16) mm. Color black; basal two abdominal segments, except the extreme base of the first and often a narrow apical margin of the second, rufo-ferruginous, the coloration sometimes extending to the basal part of tergite 3; middle inner and upper outer orbits each with a very small pale spot; neck marked with pale yellow. Wings fuliginous, iridescent or somewhat violaceous, the fore wing usually with a slightly paler crescentic streak just beyond the 3d submarginal cell and 3d discoidal cell. Pubescence very fine, brownish, usually silvery on the sides of the lower front. Head and thorax clothed rather densely with fine brownish pile.

Clypeus from 2 to 2.2 × as broad as high, the apical margin evenly arcuate. Front broad, though somewhat less so than in *angustatus*, middle interocular distance from .59 to .64 × transfacial distance. Inner orbits subparallel below, converging rather strongly above the middle, upper interocular distance approximately .75 × lower interocular distance. Ocelli of moderate size, post-ocellar line usually slightly greater than ocello-ocular line. Antennae long and slender, the first 4 segments in a ratio of about 3 : 1 : 4.5 : 3.5, segment 3 about .9 to 1.0 × upper interocular distance. (Head shown in Fig. 46.)

Posterior pronotal margin subarcuate or very feebly angulate. Propodeum with the median line well impressed. Spines of the tarsal comb slender, from 1.5 to 2 × as long as the width of the tarsus. Venation as described under the generic heading and shown in Fig. 59.

MALE.—Length 10 (7–13) mm. Color black, the abdomen usually but not always marked with rufous on part or all of the basal three segments, the body marked with pale yellowish as follows: anterior and posterior orbits narrowly; a pair of spots on the neck, sometimes connected; posterior margin of pronotum with a stripe, interrupted medially; a small spot on the axillary sclerites of the fore wing, close to the tegulae; sides of the posterior rim of the propodeum; apical abdominal tergite; a streak on the basal half of the hind tibia on the outer side; and broad basal rings on segments 2, 3, and 4 of the middle and hind tarsi. Wings clear hyaline, the hind wings infuscated at the tip, the fore wings broadly fuscous beyond the stigma and the middle of the third discoidal cell, with a paler crescentic streak just beyond the 3d submarginal cell and 3d discoidal cell. Pubescence brownish-cinereous, grading into silvery on the lower front, sides of the thorax, and propodeum; sometimes very extensively silvery. Head and prothorax, including the coxae, with a considerable amount of short, brownish hair; remainder of thorax and propodeum with a smaller amount of usually paler hair; tergite 1 with some pale hair; apical abdominal segments somewhat dark-setose, especially ventrally.

Clypeus about or a little more than twice as broad as high, its apical margin rounded or subtruncate. Front of moderate breadth, middle interocular distance from .59 to .64 × transfacial distance. Inner orbits slightly convergent above, upper interocular distance from .85 to .97 × the lower. Ocelli of moderate size; post-ocellar line is to the ocello-ocular line about as 5 : 4. First 4 antennal segments in a ratio of about 3 : 1 : 3 : 3, segment 3 about 2.5 × as long as thick.

Posterior pronotal margin subarcuate or subangulate. Propodeum with the median line vaguely impressed, the brilliant silvery pubescence diverging from the median line. Abdomen rather variable in shape, even in males from the same locality. In some specimens the first segment is extremely slender, the sides nearly parallel in dorsal aspect, the segment barely expanded in lateral aspect, the abdomen having a stalked appearance and attaining its full diameter at the 3d segment. In others the first segment is considerably expanded posteriorly and the abdomen attains its full diameter at the 2d segment. The subpetiolate abdomen, the red and yellow maculations, and the long, conspicuously banded hyaline wings make the males of this species one of the most bizarre and attractive of native Pompilidae.

Biology.—The Peckhams (1898) found this species nesting in the soft earth of their potato field. Of ten spiders captured, nine were a single species of *Thomisus*, and one an immature male lycosid. The species has the curious habit of mutilating the legs of its victims. This instinct is not so well developed as in some Auplopodini, for example, which cut off all the legs neatly at the base. Nor is it apparently for feeding purposes. The Peckhams believed it to be related to the fact that the wasp makes a small nest in comparison to the size of the prey; in the cases observed there was always some difficulty in getting the spider into the nest, and a particular tendency to bite at the legs at this time. Once the prey is in place and the egg laid, the tunnel is filled by use of the mandibles and the tarsal comb, with the tip of the abdomen used to pound or rub down the earth, or even to sweep with. Once the nest is filled, bits of sticks, dead leaves, pebbles, and other debris are placed over the entrance for concealment.

This species is occasionally attracted to honeydew, and has also been taken on the flowers of *Daucus carota, Cicuta maculata,* and *Ampelopsis arborea.* In the northern parts of its range, it appears to have but one generation per year, appearing on the wing in July and August; farther south its flight season extends from May until October, and it probably has two generations a year here.

Distribution.—Austroriparian and Carolinian faunas of central and eastern United States.

Specimens seen: 241 (167 ♀♀, 74 ♂♂). The following records are marginal· CONNECTICUT: Hartford Co., 19 ♀♀, 12 ♂♂, East Hartford, 13 July–24 Aug. [HEE, CU]; NEW YORK: Long Island, 1 ♀, Cold Spring Harbor [MCZ]; NEW JERSEY: Camden Co., 1 ♀, 1 ♂, 26–28 July [USNM]; MARYLAND: Montgomery Co., 1 ♂, Plummers Island, 29 June [USNM]; WEST VIRGINIA: Monongalia Co., 1 ♀, 18 July [CU]; OHIO: Lucas Co., 1 ♂, 9 July [JEG]; MICHIGAN: Newaygo Co., 1 ♀, White Cloud, 16 July [USNM]; ILLINOIS: Cook Co., 3 ♀♀, Chicago, July–Aug. [MCZ]; MINNESOTA: Anoka Co., 1 ♀, Fridley sand dunes, 19 July [Minn.]; NEBRASKA: Thomas Co., 2 ♀♀, Halsey, 12–15 Aug. [Minn.]; KANSAS: Finney Co., 1 ♂, 11 Aug. [coll. R. L. Fischer]; TEXAS: Bexar Co., 5 ♀♀, 1 ♂, Apr.–July [JEG]; ALABAMA: Mobile Co., 1 ♂, Oak Grove, 19 July [MCZ]; FLORIDA: Dade Co., 2 ♂♂, Biscayne Bay [ANSP, AMNH] (and many other records from Florida).

3. **Sericopompilus neotropicalis** (Cameron) new combination
(Plate XIV, fig. 42; plate XV, figs. 45, 49.)

Pompilus neotropicalis Cameron, 1893, Biol. Centr.–Amer., Hymen., II, p. 203. [Type: ♀; San Geronimo, Guatemala (Champion); British Museum (not seen by author).]

Pompilus guatemalensis Cameron, 1893, Biol. Centr.-Amer., Hymen., II, p. 206. [Type: ♂; San Geronimo, Guatemala (Champion); British Museum (not seen by author).] New synonymy.

Psammochares posticatus Banks, 1910, Jour. N. Y. Ent. Soc., 18: 119. [Type: ♂; Lee Co., Texas, 2 Oct. 1905 (Birkmann); M.C.Z. no. 13,709.] New synonymy.

Psammochares fuscipennis var. *georgiana* Banks, 1911, Proc. Ent. Soc. Wash., 13: 238. [Type: ♀; Bainbridge, Ga., 17 Sept.–19 Oct. 1910 (J. C. Bradley); M.C.Z. no. 13,711.] New synonymy.

Sericopompilus posticatus Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229.

Psammochares georgiana Banks, 1912, Canad. Ent., 44: 198.

Psammochares (*Sericopompilus*) *georgiana* Banks, 1917, Bull. Mus. Comp. Zool., 61: 108.—Brimley, 1936, J. Elisha Mitchell Sci. Soc., 52: 126. [N. C., several localities.]—Brimley, 1938, Insects N. Carolina, p. 433.

Psammochares (*Sericopompilus*) *posticatus* Banks, 1917, Bull. Mus. Comp. Zool., 61: 108.

Despite a considerable amount of variation in color, this species may be easily separated from its relatives by the characters given in the key to species. There seems to be no correlation between color variation and geographic distribution except for a general tendency for specimens from the southern parts of the range to be more extensively marked with red and yellow.

FEMALE.—Length 14 (10.5–17) mm. Color black, the entire abdomen rufo-ferruginous, the legs varying from wholly black to wholly rufous, most commonly with the hind legs partly or mostly rufous, the remaining legs black; the following are marked with pale yellowish: middle inner and upper outer orbits with small spots, a spot on each side of the neck, a band along the posterior margin of the pronotum (in U. S. specimens often obsolescent), and a small spot on the axillary sclerites of the fore wing, close to the tegulae. Wings wholly fuliginous, with a slightly darker area along the outer margin. Pubescence brownish or cinereous, grading into silvery (usually) on the front and clypeus, and sometimes on the hind coxae and propodeum. Head, thorax, and propodeum with considerable short, inconspicuous hair.

Clypeus from 2.2 to 2.4 × as broad as high, its apical margin arcuate on the sides, truncate medially. Front broad, middle interocular distance .61 to .66 × transfacial distance. Inner orbits subparallel below, middle and lower interocular distance nearly equal, rather strongly convergent above, upper interocular distance from .7 to .8 × the lower. Ocelli large and prominent; post-ocellar line is to ocello-ocular line about as 3:2. Antennae long and slender, the first 4 segments in a ratio of about 3:1:5:3.5, segment 3 from .9 to 1.2 × upper interocular distance. (Head shown in Fig. 45.)

Posterior margin of pronotum subarcuate or feebly angled. Propodeum with a distinct median linear groove. Spines of the tarsal comb from 1.5 to 2 × as long as the width of the tarsus; front tibiae rather spinose above. Venation as described under the generic heading.

MALE.—Length 9.5 (7.5–12) mm. Color black, the 2d and sometimes the adjacent abdominal segments rufous, or the abdomen occasionally without rufous markings; the following are pale yellow: inner and outer orbits with small spots (usually), a spot on each side of the neck, a broad band along the posterior margin of the pronotum, a spot on the axillary sclerites of the fore wing and usually one on the tegulae and on the mesonotum adjacent to it, lateral corners of the posterior rim of the propodeum, apical abdominal tergite, hind tibia with a streak on the outer side for the basal two-thirds, and broad basal rings on segments 1, 2, 3, and 4 of the middle tarsi and segments 2, 3, and 4 of the third tarsi. Wings clear hyaline, the tips of the hind wings fuscous or not, the fore wings broadly brownish-fuscous beyond the stigma and the middle of the 3d discoidal cell, and usually with a paler, crescentic streak within this fuscous area, just beyond the cells; in a few specimens there is a fuscous blotch over the basal vein, and occasionally the wing is lightly infuscated between this and the outer marginal band; many specimens show a whitish bloom on the hyaline part of the wings. Pubescence brownish-cinereous, more or less silvery over a considerable part of the head, thorax, and propodeum, and sometimes the base of the abdomen.

Clypeus about 2.3 × as broad as high, its apical margin truncate. Front broad; eyes distinctly converging above, upper interocular distance about .9 × the lower. Ocellar triangle somewhat elevated, the ocelli large; postocellar line much greater than ocello-ocular line (Fig. 49). First 4 antennal segments in a ratio of about 3:1:3:3, segment 3 about 2.5 × as long as thick. Pronotum subarcuate or feebly angulate behind. Propodeum with the median line lightly impressed, the silvery pubescence diverging from it. Abdomen variable in shape as in *apicalis*, although the basal segments are never quite as slender as they sometimes are in that species. Apical segments as described under the generic heading; genitalia as shown in Fig. 42.

Biology.—This species inhabits open country, more particularly in arid regions. It is a frequent visitor to flowers, having been taken on *Asclepias, Baccharis glutinosus, Tamarix gallica,* and *Sphaeralcea angustifolia.*

Distribution.—This is primarily a Mexican species, which is not uncommon throughout the Lower Austral Zone of the United States, though it seems to be more prevalent in desert or semi-desert areas.

Specimens seen: 131 (62 ♀♀, 69 ♂♂). The following records are marginal: NORTH CAROLINA: Moore Co., 3 ♀♀, Southern Pines, June, Aug., Sept. [MCZ]; GEORGIA: Fulton Co., 2 ♀♀, Atlanta, June–July [USNM, EU]; ILLINOIS: Morgan Co., 1 ♂, Meredosia, 19 Aug. [AMNH]; TEXAS: Lee Co., 1 ♂, 2 Oct. [MCZ]; El Paso Co., 1 ♀, Canutillo, 24 July [HEE]; ARIZONA: Maricopa Co., 1 ♂, Phoenix, 17 July [CIS]; CALIFORNIA: Contra Costa Co., 2 ♀♀, Antioch, 10–24 Oct. [CIS, CAS]; MEXICO: Baja California, 1 ♀, La Paz, 5 June [CAS]; Yucatan, 1 ♀, Chichen Itza, 29 June [MCZ]; LOUISIANA: St. Landry Co., 6 ♂♂, Opelousas [USNM]; ALABAMA: Mobile Co., 1 ♀, Mobile [MCZ]; FLORIDA: 1 ♂ (no further data) [USNM].

VI. Genus **EPISYRON** Schiødte

Episyron Schiødte, 1837, Krøyer's Naturhist. Tidsskr., 1: 341. [Type: *Sphex rufipes* Linnaeus, 1758; monobasic.]—Banks, 1911, Jour. N. Y. Ent. Soc., 19: 223, 229.—Sustera, 1913, Verh. zool.-bot. Ges. Wien, 62: 181, 204.—Dreisbach, 1949, Ent. Amer., (n.s.)29: 5, 38, pl. III, fig. 11.

Spilopompilus Ashmead, 1902, Canad. Ent., 34: 81. [Type: *Pompilus biguttulatus* [*sic*] Fabricius, 1798; monobasic.]

Episuron Ashmead, 1902, Canad. Ent., 34: 82. [*Lapsus calami* for *Episyron* Schiødte.]

In our fauna a single character will readily separate members of the genus *Episyron* from all other Pompilidae: the presence of scales on the first abdominal tergite, propodeum, and parts of the thorax. Elsewhere, however, certain species belonging to other genera also possess this character. The species of *Episyron* are very similar and often not easily separated. The male genitalia are all very similar. Arnold[37] and Yasumatsu[38] profess to have found subtle differences in the genitalia of the African and Japanese species respectively; I have failed, however, to find any constant specific characters in those of the American forms. This homogeneity, along with the existence of certain specialized characters in the genus, suggests that *Episyron* may have evolved rather recently, probably from stock resembling *Sericopompilus*. Judging from its wide distribution and the relative abundance of some of the species, it appears to be a very successful genus.

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[37] Arnold, G., 1936, Ann. Transvaal Mus., 18: 446.

[38] Yasumatsu, K., 1937, Mushi, 10: 42.

Generic characters.—Small or medium-sized wasps, 5 to 17 mm. in length. Ground color black, many species exhibiting whitish markings on the pronotum, abdomen, and legs, and some having the legs partly or wholly rufous. Body with the usual fine, close pubescence, and in addition to this with a coarse, squamiform pubescence covering much of the first abdominal tergite, and generally portions of the propodeum, postnotum, metanotum, and pronotum, occasionally parts of the mesopleura, coxae, scutellum, and the other abdominal tergites. Body with a variable amount of erect hair; female pygidium without bristles.

Palpi long and slender. Mandibles bidentate in the female, unidentate in the male. Labrum protruding slightly from beneath the clypeus, its apical margin bristly, with a median notch. Clypeus large, slightly convex, its upper margin somewhat sinuous. Malar space short or practically absent. Eyes in the female converging above, sometimes strongly. Antennae in general rather elongate, but in some males rather short.

Pronotum sloping evenly in front. Postnotum strongly developed, constricted on the median line, where it may or may not be concealed by the overhanging metanotum, constricted again just in front of the spiracles; between the constrictions the posterior margin is arcuately expanded. Propodeum often with a well-defined posterior declivity in the female, otherwise with even contours. Front tibia with a number of spines above, at least on the distal half; front tarsus of female with a strong comb. All the claws in both sexes bifid, the inner ray obliquely truncate; the claws of the front pair in the male are nearly alike, and the apical tarsal segment is unmodified. Pulvillar pad small, the comb weak, of not more than nine weak setulae. Apical tarsal segments spined beneath in the female, often not strongly, in the male not or but weakly spined.

Fore wings with a vena spuria just above the media, along which the wings fold longitudinally in repose; this vena spuria is indicated as a line along which the setulae of the wing are densely concentrated. Basal and transverse median veins of fore wing interstitial or nearly so; stigma rather small; 2d and 3d submarginal cells in our species both 4-sided, the 1st and 3d transverse cubital veins oblique in opposite directions, the 2d suberect; subdiscoidal vein not reaching the wing margin. Anal lobe of hind wing fairly large, about half the length of the submedian cell; cubitus of this wing arising usually before the tip of the submedian cell, but sometimes at or a little beyond. (See fig. 60.)

Abdomen subfusiform, stouter in the female than in the male. Sternite 6 of male strongly emarginate; subgenital plate strongly elevated medially, the apex broadly rounded or subtruncate. Genitalia (Fig. 61) with the basal hooklets strong, double. Aedoeagus and parapenials simple; digiti subspatulate, with numerous short setae on the disc and outer margins, and a few at the base. Parameres with strong squamae about half-way out, setose here and at the tip. There is considerable individual variation in the male genitalia but, so far as I have been able to determine, no constant specific characters in the American forms. The genitalia are therefore not discussed further in this genus.

Biology.—The members of this genus occur usually in sandy or gravelly areas, where they nest in the earth. They are unusually swift in their actions, not only in flight but in the process of nesting. Their prey seems always to consist of orb-weavers (Epeiridae). The egg is not firmly fastened to the spider as in most Pompilidae, but is placed on the wall of the cell. The biology of the American species, so far as known, is discussed under the various species. A resumé of that of the genotype, *rufipes* L., may be found in Richards and Hamm.[39]

Distribution.—Members of this genus occur in all the zoogeographic regions of the world except, so far as I know, the Australian. Twelve species have been described or recorded from the Nearctic region, of which I consider but four valid, and describe a fifth.

Key to Species

Females

1. Front basitarsus with 4 (rarely 5) comb-spines of considerable length, the basal one often smaller than the others; eyes not strongly convergent above, upper interocular distance approximately .85 × lower interocular distance; vertex not strongly raised above the tops of the eyes 2

Front basitarsus with only 3 comb-spines; eyes more strongly convergent above, upper interocular distance less than .78 × the lower, or the front very broad and the vertex arcuately raised above the tops of the eyes ..3

2. Apical abdominal tergite with a white spot (sometimes concealed by the overlapping of the preceding tergite) and the abdomen with from 2 to 6 paired spots, sometimes united into bands, on tergites 2 to 4; pubescence of head and thorax usually extensively silvery; fore wings subhyaline, the outer margin with a fuscous band
1a. **quinquenotatus quinquenotatus** (Say)

Abdomen wholly black, or rarely with from 1 to 3 small or faintly indicated spots; pubescence dark, at most silvery on the lower front; fore wings more or less infuscated, only slightly darker along the outer margin .... 1b. **quinquenotatus hurdi** new subspecies

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[39] Richards, O. W., and Hamm, A. H., 1939, Trans. Soc. Brit. Ent., 6: 101.

3. Third antennal segment subequal to or greater than upper interocular distance; vertex less broad than below, and scarcely raised above the tops of the eyes; ocelli in a more compact triangle, the front angle of which is about or slightly greater than a right angle (fig. 52) 4

Third antennal segment equal to .9 or less × upper interocular distance; ocelli forming a very flat triangle, the front angle distinctly greater than a right angle; vertex very broad, more or less arcuately raised above the tops of the eyes (fig. 53) 6

4. Legs partly or wholly rufo-ferruginous; head and thorax with moderately abundant pale hair; tarsal comb very strong, the apical basitarsal spine about 1.5 × the length of the 2d tarsal segment
2. **posterus** (Fox)

Legs black; head and thorax with abundant black hair; apical basitarsal comb-spine slightly if any longer than the 2d tarsal segment ..5

5. Body dull black, the pubescence rather vaguely reflecting bluish or purplish, on the lower front often silvery; abdomen often with 2 whitish spots, but sometimes with 4 or 6, or none at all; wings subhyaline or lightly infuscated, with a darker marginal band, not or but slightly violaceous ....3a. **biguttatus biguttatus** (Fabricius)

Body black, rendered by the pubescence rather brilliantly deep bluish or purplish; abdomen not spotted; fore wings fuscous, with a less contrastingly darker marginal band, usually rather strongly violaceous
3b. **biguttatus californicus** (Banks)

6. Scape, pronotum, propodeum, tergite 1, and in fact almost the entire head and thorax rather conspicuously hairy; pronotum shorter, its posterior margin feebly angulate; temples well developed
4. **oregon** new species

Body unusually free of erect hair, the scape, pronotum, propodeum, and tergite 1 at most very slightly hairy; pronotum rather long, nearly or quite as long as the mesonotum, its posterior margin arcuate; head very thin, lenticular, the temples reduced ....5. **snowi** (Viereck)

Males

1. Outer flagellar segments (except the last) not more than about 1.5 × as long as their greatest thickness (Figs. 65 and 66); middle and hind tibial spurs almost pure white; mandibles tricolored, black at the base, whitish in the middle, and ferruginous at the apex; head and pronotum with mostly pale hairs 2

Outer flagellar segments from 1.5 to 2.5 × as long as thick (figs. 63 and 64); spurs varying from dirty white to black; mandibles bicolored, black tipped with dark ferruginous; head and pronotum with mostly dark hairs 3

2. Pronotum short, shorter than the mesonotum; antennae slightly longer, the segments not noticeably imbricate (fig. 65); wings largely hyaline, but without a whitish bloom; hind margin of pronotum with a broad pale yellowish stripe, mesonotum often marked with yellowish; legs often reddish ....2. **posterus** (Fox)

 Pronotum rather long, almost or quite as long as the mesonotum; antennae short, with a slight constriction between each of the outer flagellar segments, and each segment somewhat produced over the next (fig. 66); wings with a whitish bloom; pronotum occasionally with a pale band, the mesonotum never marked with pale.
 5. **snowi** (Viereck)

3. Vertex raised rather strongly and evenly above the tops of the eyes, and the temples moderately developed (fig. 50); vertex very broad, the ocelli in a broad, flat triangle; apical abdominal tergite black or slightly suffused with pale. ....4. **oregon** new species

 Vertex not strongly arcuately raised above the tops of the eyes; temples not well developed, the head in general considerably thinner (fig. 51); apical tergite with a large whitish spot 4

4. Hind margin of pronotum usually more or less angulate; apex of front tibia and base of hind tibia marked with pale on the outer side, or both these parts without pale markings; somewhat smaller: 8 (5.5–12) mm. 5

 Hind margin of pronotum arcuate or very feebly angulate; front tibiae never marked with pale, but the hind tibia always with a pale spot or stripe on the outer side basally; size generally larger: 9 (6.5–13) mm. 6

5. Head and thorax extensively silvery-sericeous; tergite 3 usually with paired white spots or a white band, sometimes also tergite 2
 1a. **quinquenotatus quinquenotatus** (Say)

 Body silvery-sericeous at most on the lower front, elsewhere dark-pubescent (exclusive of the scales); abdomen rarely with more than the apical tergite white .....1b. **quinquenotatus hurdi** new subspecies

6. Pubescence in large part silvery, nowhere more than vaguely reflecting bluish; spurs usually pale; tergite 3 usually with paired white spots or a band, sometimes also tergite 2 and/or tergite 4
 3a. **biguttatus biguttatus** (Fabricius)

 Pubescence silvery at most on the lower front, elsewhere dark and more or less evidently reflecting deep blue or purplish; spurs black; abdomen rarely with more than the apical tergite white
 3b. **biguttatus californicus** (Banks)

1a. Episyron quinquenotatus quinquenotatus (Say)
(Plate XVI, fig. 61.)

Pompilus quinquenotatus Say, 1835, Boston Jour. Nat. Hist., 1: 304. [Type: ♀; "Indiana"; (no longer extant).]—Smith, 1855, Cat. Hymen. Brit.

Mus., III, p. 160.—Provancher, 1882, Nat. Canad., 13: 40. [Considered synonym of *biguttatus* Fabr.]—Dalla Torre, 1897, Cat. Hymen., VIII, p. 276. [Listed as synonym of *biguttatus* Fabr.]—Peckham and Peckham, 1898, Wisc. Geol. Nat. Hist. Survey Bull. no. 2, pp. 126-138. [Biology.]

Pompilus biguttatus var. *5-notatus* Cresson, 1867, Trans. Amer. Ent. Soc., 1: 97.

Pompilus griseus Provancher, 1882, Nat. Canad., 35, 36. [Lectotype: ♂ (not ♀ as described); Chicoutimi, Quebec; QPM yellow label no. 1011.] New synonymy.—Provancher, 1883, Nat. Canad., 14: 35.—Dalla Torre, 1897, Cat. Hymen., VIII, p. 293.

Episyron quinquenotatus Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229.—Rohwer, 1916, Conn. Geol. Nat. Hist. Survey Bull. 22, p. 631.—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 896.—Johnson, 1930, Ins. Fauna Nantucket, p. 110.—Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 121. [N. C., several localities.]—Brimley, 1938, Insects N. Carolina, p. 433.—Procter, 1938, Biol. Survey Mt. Desert Reg., VI, Insecta, p. 429. [Mt. Desert, Me.]—Strickland, 1947, Canad. Ent., 79: 125. [Alta., several localities.]

Episyron griseus Rohwer, 1916, Canad. Ent., 48: 371.

As the long list of references suggests, this is a common wasp in the eastern United States and Canada. Some authors have doubted its distinctness from *biguttatus;* however, a number of good characters, as indicated in the key, will separate the females. The males are another matter. The Peckhams (1898) state that the males of *biguttatus* "may be seen attempting to mate not only with females of their own kind but also with those of *quinquenotatus*"—a reflection of the difficulty of separating the two species in this sex. Even today really precise characters for separating the males of *quinquenotatus* and *biguttatus* are not known. The couplet for separating them in the key was arrived at after considerable trial and error; it is hoped that in most cases it will work satisfactorily.

FEMALE.—Length 10 (6.5–13) mm. Ground color black, the body marked with a variable amount of pale buff, as follows: inner and outer orbits with narrow stripes; posterior pronotal margin with or without a stripe; apical abdominal tergite with a spot, which may be concealed when the abdomen is telescoped; tergite 3 with a pair of transverse spots which are sometimes confluent medially, forming a band; tergites 2 and 4 either with or without spots, which when present may or may not be united to form bands; tip of front tibia and base of hind tibia occasionally with small spots. Wings subhyaline, the outer margin of the fore wing and apex of the hind wing broadly fuscous. Body with a fine brownish pubescence which varies to silvery on the clypeus and front, and usually also on the coxae and much of the thorax, especially the pleura, and occasionally on the bases of several of the abdominal tergites. Squamiform pubescence covering most of tergite 1, where it is usually dingy or somewhat coppery, the propodeum, especially the posterior slope and anterior margin, postnotum, metanotum medially, sides of the scutellum, pronotum anteriorly, upper mesopleura, and hind coxae above; on the thorax and propodeum it is generally whitish, sometimes slightly greenish. Body with rather abundant short dark hair, as follows: scape, clypeus, front, vertex, temples, pronotum, propleura, front coxae, mesopleura, metanotum, propodeum, and tergite 1 all rather conspicuously; middle and hind coxae slightly hairy; apical abdominal segments slightly setose.

Clypeus from 2.2 to 2.5 × as broad as high, its apical margin truncate, slightly raised. Front broad, middle interocular distance from .60 to .63 × transfacial distance. Inner orbits emarginate near the middle, middle interocular distance from 1.0 to 1.1 × lower interocular distance, somewhat convergent above, upper interocular distance from .80 to .88 × lower interocular distance. Front in profile rather strongly convex; vertex scarcely elevated above the tops of the eyes. Ocelli in a right triangle or slightly greater; post-ocellar line is to ocello-ocular line about as 9:8. Antennae elongate, the first 4 segments in a ratio of about 6:2:10:7, segment 3 from .82 to .91 × upper interocular distance. Temples not well developed, the head contracted immediately behind the eyes.

Pronotum short, its posterior margin subarcuate. Propodeum with the slope even, the declivity defined only by a heavy band of scales. Tarsal comb strong, the spines slightly flattened; basitarsus with 4 or rarely 5 comb-spines, the basal one smaller than the others, the apical one considerably longer than the 2d tarsal segment. Venation as described under the generic heading; marginal cell about its own length from the wing-tip; 3d submarginal cell usually shorter both above and below than the 2d.

MALE.—Length 8 (5.5–12) mm. Color black, marked with pale buff as follows: inner and outer orbits narrowly, posterior pronotal margin with or without a stripe which is interrupted medially, a spot at the apex of the front tibia, sometimes a spot at the apex of the front femur, usually a spot or stripe on the base of the hind tibia, entire apical tergite, a pair of transverse spots on tergite 3 which may be united to form a band, and sometimes paired spots on tergite 2 and/or tergite 4; spurs occasionally pale. Some or all of the abdominal markings may be concealed if the segments are telescoped. Wings hyaline, the outer margin of the fore wing and apex of the hind wing broadly fuscous. Pubescence silvery over much of the head and thorax, on the abdomen brownish, but the basal tergites silvery at the base. Scales distributed about as in the female, and colored similarly; head, thorax, and propodeum with abundant dark hairs about as in the female.

Clypeus about twice as broad as high, its apical margin truncate. Middle interocular distance from .60 to .64 × transfacial distance; middle interocular distance about 1.2 × the lower; upper interocular distance about 1.1 × the lower, the inner orbits thus distinctly convergent above. Ocelli in a flat triangle, post-ocellar line and ocello-ocular line subequal, or either slightly the greater. Scape short; first 4 antennal segments in a ratio of about 5:2:6:6; antennal segments 9 to 12 from 1.6 to 2.2 × as long as their greatest thickness. Temples not at all developed. Pronotum short, its posterior margin varying from feebly to distinctly angulate. Longer spur of hind tibia about .8 the basitarsus. Venation as in the female. Abdominal features as described under the generic heading; genitalia shown in fig. 61.

Biology.—This wasp has been dubbed the "Tornado Wasp" by the Peckhams (1898) because of the furious pace of its activities. The Peckhams found it nesting in their garden. The prey, in more than 50 examples, was always *Epeira strix* Emerton (i.e., *E. foliata* Fourcroy). The spider is stung severely and often killed; it is carried either by dragging it by one leg and running backward, or in flight. Once a nesting site is found, the spider may be hung in the crotch of a low plant or merely left on the ground during excavations, which take only about 20 minutes. Then the spider is hastily dragged into the nest, usually an oblique burrow about three inches deep, and an egg laid in the cell, the burrow finally being filled quickly with sand. The whole operation is performed with a great deal more speed than is usual among spider wasps.

My own observations essentially confirm those of the Peckhams, except that in the vicinity of Ithaca, N. Y., it preys upon *Eustala anastera* (Walck.) [det. B. J. Kaston] (and probably other epeirids). It is not an uncommon wasp, preferring open sand, and being on the wing from June until September. It visits flowers rather frequently, and is recorded from *Daucus carota, Pastinaca sativa, Anaphalis margaritacea, Solidago rigida,* and *Baccharis salicina;* the species also visits honeydew.

Distribution.—This species occurs throughout the Canadian, Alleghanian, and Carolinian faunas of eastern United States and Canada, being more common northward; westward it ranges sparingly to Texas, Colorado, Montana, and British Columbia.

Specimens seen: 382 (191 ♀♀, 191 ♂♂). The following records are marginal as far as present available data indicate: NOVA SCOTIA: 1 ♀, Petite Riviere, July [CNC]; PRINCE EDWARD ISLAND: 1 ♀, 1 ♂, Canad.

Nat. Park, 21 July [CNC]; QUEBEC: 1 ♂, Chicoutimi [QPM]; 1 ♂, Kazabazua, Aug. [CNC]; ONTARIO: 1 ♀, Haileybury, July [CNC]; MINNESOTA: Cook Co., 2 ♂♂, 21 Aug. [Minn.]; MANITOBA: 1 ♀, 2 ♂♂, Aweme, July-Aug. [CNC]; SASKATCHEWAN: 1 ♂, Prince Albert, Aug. [CNC]; ALBERTA: 2 ♂♂, Wabamun, July [Alta.]; BRITISH COLUMBIA: Vancouver Isl., 1 ♀, Goldstream, 27 July [USNM]; MONTANA: Glacier Nat. Park, 1 ♂, 3 Aug. [MCZ]; WYOMING: Teton Co., 1 ♂, Jackson, 6300 feet, 13 July [AMNH]; COLORADO: Moffat Co., 1 ♂, Sunbeam, 12 July [CU]; KANSAS: Rooks Co., 1 ♀, Stockton [UK]; TEXAS: Williamson Co., 1 ♀, 4 Oct. [JEG]; ARKANSAS: 1 ♂, White River, 9 Aug. [CU]; ALABAMA: Morgan Co., 1 ♀, Decatur, 6 July [UK]; NORTH CAROLINA: (recorded by Brimley, 1936); VIRGINIA: Fairfax Co., 3 ♀♀, 1 ♂, Great Falls, 11 Sept. [MCZ].

1b. **Episyron quinquenotatus hurdi** new subspecies[40]

This form has sometimes been misdetermined as *californicus* Banks, but the latter was described from a small male of what Banks later described in the female sex as *arizonicus*. True *californicus* is a subspecies of *biguttatus* Fabricius, while *hurdi* represents a parallel case of subspeciation in *quinquenotatus*. The female *hurdi* is wholly black except at the orbits, although an occasional specimen will have a small pale spot on the apical tergite and/or a pair of small spots on the third abdominal tergite; these are usually from the northern part of the range and represent intergrades with typical *quinquenotatus*. The male *hurdi* lacks the pale spot on the hind tibia present in both subspecies of *biguttatus;* in this sex intergrades with the typical subspecies also occur, chiefly in Washington, Montana, and British Columbia.

FEMALE (Holotype).—Length 12 mm. Color black, the middle inner orbits with a small pale yellowish spot, and the outer orbits with a thin yellowish line. Wings wholy moderately infuscated, somewhat darker along the outer margin. Pubescence wholly dark, obscurely violaceous. Squamiform pubescence as in the typical subspecies, but generally darker in color. Clypeus 2.2 × as broad as high. Middle interocular distance .62 × transfacial distance; the former equal to lower interocular distance; the upper .82 × the lower. First 4 antennal segments in a ratio of 3:1:6:4, segment 3 equal to .93 × upper interocular distance. Front basitarsus with 4 comb-spines, the apical one 1.3 × the length of the 2d tarsal segment.

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[40] This subspecies, a not uncommon element in the fauna of the western United States, is named for Mr. Paul D. Hurd, Jr., of Berkeley, Calif., who collected the types, in recognition of the value of his studies of the tarantula hawks (genus *Pepsis*) and in appreciation of his assistance to me in obtaining Pompilini from the western United States.

Sixty-three female paratypes vary in size from 7 to 14 mm., the average 10 mm. A few specimens (B. C. and Ore.) show small pale spots on the 3d and/or apical tergite of the abdomen. Some specimens have a small amount of silvery pubescence on the lower front and clypeus. Upper interocular distance varies from .75 to .85 × the lower (the average degree of convergence somewhat greater than in typical *quinquenotatus*). Antennal segment 3 varies from .8 to 1.0 × upper interocular distance.

MALE (Allotype).—Length 8.5 mm. Color black, the inner and outer orbits narrowly pale, the apical abdominal tergite mostly whitish. Fore wings lightly infuscated, with a darker outer marginal band; hind wings subhyaline, the apex clouded. Pubescence fuscous, obscurely violaceous, a bit silvery on the lower front and the clypeus; squamiform pubescence largely pale gray, slightly iridescent. Clypeus 1.9 × as broad as high. Middle interocular distance .62 × transfacial distance; the middle interocular distance 1.2 × the lower; the upper 1.05 × the lower. Posterior margin of pronotum broadly but distinctly angulate.

Forty-five male paratypes vary in size from 5.5 to 10 mm., the average 8 mm. A few specimens (Mont., Wash., B. C., Calif.) have paired whitish spots on tergite 3; some specimens, chiefly from the northern part of the range, have a pale spot at the apex of the front tibia, and a few few have pale markings on the hind tibia.

Biology.—There are many records of this form having been taken on flowers. The list includes *Daucus carota, Cicuta, Cleome serrulata, Cirsium, Eriogonum, Solidago,* and *Asclepias.* A male from Hermiston, Ore., is pinned with a juvenile *Epeira* sp. [det. B. J. Kaston].

Distribution.—The form inhabits the Transition and Upper Sonoran faunas of western United States and (sparingly) Canada, from southern British Columbia and Alberta to Utah and California. Its range is somewhat more limited than that of the sibling *biguttatus californicus.*

Holotype.—CALIFORNIA: Contra Costa Co., ♀, Antioch, 24 Oct. 1948, on *Eriogonum* (P. D. Hurd) [CAS]. *Allotype.*—Eldorado Co., Calif., ♂, Chile Bar, 5 July 1948 (P. D. Hurd) [CAS].

Paratypes.—CALIFORNIA: Alameda Co., 2 ♀♀, 1 ♂, Niles Canyon, 9 Sept. [CAS]; Contra Costa Co., 13 ♀♀, Antioch, Aug.-Oct. [CAS, CIS, USNM, ANSP]; Eldorado Co., 1 ♂, Chile Bar, 5 July [CIS].; Imperial Co., 1 ♀, 1 ♂, June [USNM]; Inyo Co., 1 ♂, Independence, 14 June [CIS]; 1 ♂, Lone Pine, June [UK]; 1 ♀, Owen's Lake, 2 June [CIS]; Kern Co., 1 ♂, Shafter, 25 June [CIS]; Kings Co., 1 ♂, Lemoore, 500 ft., 6 Aug. [CU]; Monterey Co., 1 ♂, Delmonte, 8 May [CAS]; Riverside Co., 1 ♂, Taquitz Canyon, 16 Apr. [CIS]; 1 ♀, Gilman Hot Springs, 14 May

[CAS]; 1 ♀, Blythe, 7 May [CIS]; 1 ♀, Pinon Fat, 18 June [CAS]; 1 ♀, 1 ♂, Hemet Res., San Jacinto Mts., 22 May [CIS]; San Benito Co., 1 ♀, Pinnacles Mon., 3 May [CIS]; San Bernardino Co., 1 ♂, Redlands [USNM]; San Diego Co., 1 ♀, 1 ♂ [UK, CAS]; San Francisco Co., 6 ♀♀, 5 ♂♂, May-Aug. [CAS, CU, ANSP]; Santa Barbara Co., 2 ♂♂, Solomon Canyon, 12 Aug. [ANSP]; Tulare Co., 1 ♀, Lemon Cove, 9 July [CU]; Yolo Co., 1 ♂, Davis, 1 Oct. [CIS]; OREGON: Baker Co., 3 ♀♀, 5 mi. No. of Huntington, 23 Aug. [OSC]; Benton Co., 6 ♀♀, Corvallis, July-Aug. [OSC, USNM, CU]; Crook Co., 1 ♀, 1 ♂, Powell Butte, 10 July 1941 [OSC]; Deschutes Co., 1 ♀, 1 ♂, Redmond, 27 June, 19 July [OSC]; Harney Co., 1 ♂, Harney Lake, 15 July [OSC]; Klamath Co., 2 ♀♀, 7 ♂♂, 20 May–9 July [OSC, CAS]; Linn Co., 1 ♂, High Cascades, 20 July [USNM]; Marion Co., 1 ♂, Wheatland Ferry, 6 Aug. [OSC]; Umatilla Co., 1 ♀, Hermiston, Sept. [OSC]; WASHINGTON: 1 ♀, 3 ♂♂ (no further data) [ANSP]; Spokane Co., 1 ♂, 20 July [CAS]; BRITISH COLUMBIA: 1 ♂, Agassiz, 18 May [CNC]; 1 ♂, Crescent, 14 Aug. [CNC]; 1 ♂, Dog Lake, July [CNC]; 1 ♀, Penticton, 7 Aug. [CNC]; 1 ♀, Summerland, 10 Aug. [CNC]; ALBERTA: 1 ♂, Manyberries, 1 Aug. [Alta.]; MONTANA: 4 ♂♂ (no further data) [ANSP]; IDAHO· 1 ♀, Idaho Falls, 5 Aug. [UAC]; UTAH: Cache Co., 1 ♂, Logan Canyon, 12 July [UAC]; Utah Co., 14 ♀♀, Utah Lake, 16 Aug. [HEE, UAC, CU, ANSP].

2. **Episyron posterus** (Fox) (Plate XVI, fig. 65.)

Pompilus posterus Fox, 1893 (May), Canad. Ent., 25: 115. [Type: ♀; Southern Florida (Robertson); A.N.S.P. no. 4717.]—Dalla Torre, 1897, Cat. Hymen., VIII, p. 313.

Pompilus exactus Cameron, 1893 (Sept), Biol. Centr-Amer., Hymen., II, p. 202, pl. XI, figs. 23 and 23a. [Type: ♀; Temax, Yucatan, Mexico; British Museum (not seen by author).] New synonymy.

Pompilus porus Fox, 1894, Proc. Calif. Acad. Sci., (2)4: 98. [Lectotype: ♀; San José del Cabo, Baja Calif., Mexico; C.A.S. no. 240][41] New synonymy.—Dalla Torre, 1897, Cat Hymen., VIII, p. 313.

Anoplius posterus Smith, 1910, Ann. Rpt. N. J. State Mus. 1909, p. 674. [Camden Co., N. J.]

Episyron porus Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229.

Episyron posterus Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229.—Banks, 1911, Proc. Ent. Soc. Wash., 13: 238.—Robertson, 1928, Trans. Acad. Sci. St. Louis, 25: 307, 308. [Flower records, Florida.]—Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 121. [Beaufort, N. C.]—Brimley, 1938, Insects N. Carolina, p. 432.

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[41] This specimen was selected by E. P. VanDuzee from specimens labeled in Fox's hand, likewise a lectallotype bearing the same data (E. S. Ross *in litt.*). I have not seen these specimens.

The rufous legs readily separate this species from the other members of the genus; in an occasional male, the legs are wholly black, but the pure white spurs, pale hair, short antennae, and short pronotum will identify these. Some females have the legs wholly rufous (*exactus* Cameron); these are chiefly from the deep Southwest and from Mexico. Others, from many parts of the range, have only the hind legs rufous; I have also seen a few specimens with the middle and hind legs rufous, the front pair black.

FEMALE:—Length 10 (6.5–13) mm. Color black, marked with pale yellow and rufous. The following are pale yellow: inner and outer orbits always, but with a variable amount; the neck; often a band along the posterior pronotal margin; small spots on the bases of the front wings, just behind the tegulae; rarely a rectangular spot on the mesonotum; sometimes two spots on the base of tergite 3. At least the greater part of the hind tibiae and femora are bright rufo-ferruginous; occasionally all the legs except the coxae and trochanters are rufous, and intermediates occur between these two extremes. Wings hyaline or lightly infuscated, the outer margin of the fore wing and apex of the hind wing with a fuscous band. Pubescence brownish, varying to silvery at least on the front and clypeus, often over a large part of the head and thorax and sometimes forming bands at the bases of some of the abdominal tergites. Squamiform pubescence present on tergite 1, the propodeum, postnotum, metanotum, pronotum, and often the upper part of the mesopleura, the sides of the scutellum, and the upper part of the hind coxae; the coloration of the scales varies from coppery through silvery to a distinct pale greenish. Head, thorax, propodeum, and tergite 1 with abundant erect hairs which are for the most part pale; apex of abdomen with a few black setae.

Clypeus from 2.2 to 2.4 × as broad as high, its apical margin truncate. Front of moderate breadth, middle interocular distance usually about .61 × transfacial distance; middle interocular distance about 1.05 × the lower; upper interocular distance from .7 to .8 × the lower, the eyes thus distinctly convergent above. Vertex scarcely raised above the eye-tops. Ocelli forming a right angle or slightly greater in front; post-ocellar line is to ocello-ocular line about as 5:4. Antennae slender, the first 4 segments in a ratio of about 3:1:5:4, segment 3 subequal to upper interocular distance.

Pronotum short, its posterior margin arcuate. Propodeum with even contours, a little steeper behind. Front tarsus with a strong comb; there are 3 comb-spines on the basitarsus, the apical one about 1.5 × the length of the 2d tarsal segment. Fore wing with the stigma short, the marginal cell long, about its own length from the wing-tip. Third submarginal cell smaller than the 2d; 1st transverse cubital vein strongly oblique, starting well basad of a line drawn perpendicular to the costa at the base of the stigma; 2d transverse cubital vein erect, nearly straight; 3d oblique, straight or slightly arched.

MALE.—Length 8.5 (6–9.5) mm. Color black, marked with pale yellow as follows: inner and outer orbits narrowly; a spot on each side of the neck; a band on the posterior margin of the pronotum; a spot on the base of the fore wing, just behind the tegulae; sometimes a spot on the tegulae; sometimes a spot on the mesonotum; sometimes a pair of spots on tergite 3; apical tergite; a stripe on the basal part of the outside of the hind tibia; usually a small spot at the tip of the front femur and one at the tip of the front tibia. All the spurs are white; there may also be a small white spot on the scape; a white spot is usually present on the mandibles and renders these tricolored, the base being black and the apex ferruginous. The legs vary from wholly black (except for the pale markings indicated above) to wholly rufo-ferruginous beyond the trochanters; often only the hind legs are rufous. Wings hyaline, the outer margin of the fore wing and apex of the hind wing banded with fuscous. Pubescence in large part silvery, on the abdomen mostly brownish, with basal silvery bands on the first 3 segments, and the last 3 tergites mostly silvery. Squamiform pubescence about as in the female. Head, thorax, propodeum, and tergite 1 with considerable pale erect hair.

Clypeus about 1.8 × as broad as high, its apical margin truncate. Front of moderate breadth, middle interocular distance varying from .58 to .61 × transfacial distance. Middle interocular distance about 1.2 × the lower; upper interocular distance about 1.05 × the lower. Ocelli rather large, post-ocellar line usually slightly greater than ocello-ocular line. Antennae relatively short and thick; first 4 segments in a ratio of about 3:1:2.5:2.7; segment 3 about 1.7 × as long as its greatest thickness; segments 8 through 12 each about 1.5 × as long as their greatest thickness (fig. 65). Temples not well developed.

Pronotum very short, its posterior margin arcuate. Mesonotum very wide, making the thorax unusually broad between the wing bases. Longer spur of hind tibia about .8 × the basitarsus. Venation as in the female. Abdomen somewhat flattened above; characters of the terminal segments as described under the generic heading.

Biology.—Like its congeners, this species is partial to sandy places and preys on epeirid spiders. A female from Farmingdale, Long Island, N. Y., was taken with the spider *Eustala anastera* (Walck.) [det. H. Blauvelt]. There are many records of this species having been taken on flowers; the list includes *Thysanella fimbriata, Ceanothus microphyllus, Chilopsis, Helianthus, Baccharis glutinosus,* and alfalfa.

Distribution.—This is a Tropical and Lower Austral species, ranging from Central America north to California, Texas, Illinois, and Long Island, N. Y.

Specimens seen: 106 (68 ♀♀, 38 ♂♂). The following records appear to be marginal: NEW YORK: Long Island, 1 ♀, Farmingdale, 4 July [KVK]; NEW JERSEY: Burlington Co., 1 ♀, Brown's Mills, 11 June [AMNH]; Camden Co., 1 ♀ [ANSP]; VIRGINIA: 1 ♂, Cape Henry, 24 Sept. [USNM]; NORTH CAROLINA: 1 ♀, Beaufort [USNM]; Dare Co., 2 ♀♀, 1 ♂, Kill Devil Hills, 2–5 June [KVK]; SOUTH CAROLINA: 1 ♀, Dewees Island, 29 May [MCZ]; GEORGIA: Glynn Co., 1 ♀, St. Simon's Island [CU]; FLORIDA: (many records from all parts); ALABAMA: Clarke Co., 1 ♂, 11 June [MCZ]; MISSISSIPPI: Lafayette Co., 1 ♀, Oxford, July [MCZ]; ILLINOIS: Morgan Co., 1 ♂, Meredosia, 21 Aug. [AMNH]; TEXAS: Lee Co., 2 ♀♀, Fedor, Aug., Oct. [MCZ]; Jeff Davis Co., 1 ♀, Limpia Canyon, 5000 feet, 24 July [HEE]; NEW MEXICO: Dona Ana Co., 1 ♀, Las Cruces, 5 June [ANSP]; ARIZONA: Graham Co., 1 ♂, Fort Thomas, 2700 feet, 7 Aug. [OSC]; CALIFORNIA: Lake Co., 2 ♀♀, Seda Bay, Clear Lake, 29 Sept. [CAS]; MEXICO: Baja California, 1 ♀, 1 ♂, Angeles Bay, 26–27 June [CAS]; Yucatan, 7 ♀♀, Chichen Itza, 29 June [MCZ]; GUATEMALA: 3 ♀♀, 1 ♂, Moca Guatalon, Mch.–Apr. [MCZ]; COSTA RICA: 1 ♂, San José [CU].

3. **Episyron biguttatus biguttatus** (Fabricius)
(Plate XV, figs. 51, 52; plate XVI, figs. 60, 63.)

Pompilus biguttatus Fabricius, 1798, Suppl. Ent. Syst., p. 249. [Type: ♀; "America septentrionali"; (not seen by author).]—Fabricius, 1804, Syst. Piezatorum, p. 193.—Say, 1835, Boston Jour. Nat. Hist., 1: 303.—Smith, 1855, Cat. Hymen. Brit. Mus., III, p. 158.—Cresson, 1867, Trans. Amer. Ent. Soc., 1: 96.—Provancher, 1882, Nat. Canad., 13: 35, 40.—Dalla Torre, 1897, Cat. Hymen., VIII, p. 276.—Peckham and Peckham, 1898, Wisc. Geol. Nat. Hist. Survey Bull. 2, pp. 138–140. [Biology.]

Spilopompilus biguttulatus [*sic*] Ashmead, 1902, Canad. Ent., 34: 81. [Made genotype of n. gen. *Spilopompilus*.]

Episyron atrytone Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229. [Type: ♀; Lee Co., Texas, Apr. 1912 (Birkmann); M.C.Z. no. 13,665.] New synonymy.—Banks, 1911, Proc. Ent. Soc. Wash., 13: 238.

Episyron snowi Banks, 1911, Jour. N. Y. Ent. Soc., 19: 229. [Based on misdetermination; *nec snowi* Viereck.]—Banks, 1912, Ent. News, 23: 108.—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 986.—[?]Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 121–122.—[?]Brimley, 1938, Insects N. Carolina, p. 433.

Episyron biguttatus Banks, 1911, Jour. N. Y. Ent. Soc., 19: 230.—Banks, 1912, Ent. News, 23: 108.—Rohwer, 1916, Conn. Geol. Nat. Hist. Survey Bull. 22, p. 631.—Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 986.—Robertson, 1928, Trans. Acad. Sci. St. Louis, 25: 308.—Johnson, 1930, Ins. Fauna Nantucket, p. 110—Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 121.—Brimley, 1938, Insects N. Carolina,

p. 432.—Procter, 1938, Biol. Survey Mt. Desert Reg., vi, Insecta, p. 429. —Strickland, 1947, Canad. Ent., 79: 125. [Alta.]—Dreisbach, 1949, Ent. Amer., (n.s.)29: 38, pl. III, fig. 11.

Psammochares biguttata Bromley, 1914, Psyche, 21: 192. [Preyed upon by the asilid *Proctacanthus philadelphicus*.]

This is one of the best known of American spider wasps, being very widely distributed and common over much of its range. *Biguttatus biguttatus* may be readily told from the sympatric *quinquenotatus quinquenotatus* by the lack of a pale spot on the apical abdominal tergite of the female, and by the lack of a pale spot at the apex of the front tibia of the male, in addition to the morphological differences mentioned in the keys. Males of this form have often been misdetermined as *snowi* Viereck.

FEMALE.—Length 12.5 (9–18) mm., thus very variable but averaging the largest of our native *Episyron*. Body black, marked with pale buff as follows: inner and outer orbits very narrowly, rarely a pale stripe on the posterior margin of the pronotum, usually with a pair of round or transverse spots on tergite 3, not infrequently also with paired spots on tergite 2 and/or tergite 4; outer side of hind tibia sometimes with a spot or stripe. Wings subhyaline to moderately infuscated, the outer margins contrastingly darker. Body clothed with dark pubescence which vaguely reflects deep bluish or purplish in certain lights, often silvery on the lower front, sometimes also on the temples, coxae, and lower thoracic pleura. Coarse squamiform pubescence, brownish or somewhat silvery or coppery, is present on tergite 1, the propodeum, postnotum, metanotum, pronotum, and often to some extent on the scutellum, mesopleura, and hind coxae. Head, thorax, and propodeum with a considerable amount of erect black hair; tergite 1 rather hairy, the apical abdominal segments with a few thin setae.

Clypeus about 2.4 × as broad as high, the apical margin nearly straight, the edge narrowly raised. Front broad, middle interocular distance from .57 to .63 × transfacial distance. Inner orbits subparallel below, converging rather strongly above, upper interocular distance from .65 to .78 × lower interocular distance. Ocelli forming a right angle or slightly greater in front; post-ocellar line subequal to or slightly greater than ocello-ocular line. Antennae slender, the first 4 segments in a ratio of about 4:1:6:5, segment 3 equal to from .92 to 1.3 × upper interocular distance. Head in general rather broad, transfacial distance about 1.15 × facial distance; vertex raised at most very slightly above the eye-tops; temples not strongly developed. (Fig. 52.)

Pronotum short, its posterior margin arcuate, sometimes with a slight angulation on the median line. Propodeum sloping more steeply behind, the declivity marked off by a heavy band of scales. Tarsal comb well developed, but the spines shorter than in the other native members of the genus; basitarsus with 3 comb-spines, the apical one subequal in length to the 2d tarsal segment. Wing venation as shown in fig. 60, and not differing notably from that of other members of the genus; the 1st transverse cubital vein is generally less strongly oblique than in the preceding species.

MALE.—Length 9.5 (6–13) mm. Body black, marked with pale buff as follows: inner and outer orbits narrowly; posterior margin of pronotum usually with a band which is interrupted medially; usually a pair of transverse spots on the base of tergite 3, sometimes confluent medially, sometimes concealed when the segments are telescoped; rarely there are paired spots on tergite 2 or tergite 4; apical tergite usually wholly pale; hind tibia always with a pale stripe on the outer side basally or for most of its length; spurs usually pale, but always somewhat dusky or "dirty," at least at the tips, never pure whitish as in *snowi* or *posterus*. Wings hyaline, outer margin of fore wing and apex of hind wing conspicuously banded with brownish. Body silvery-sericeous over much of the head and thorax, and usually with basal silvery bands on tergites 2 and 3. Squamiform pubescence as in the female. Head, including the scape, and the prothorax, rather densely clothed with short dark hairs; remainder of thorax and propodeum with a moderate amount of dark hair.

Clypeus slightly more than twice as broad as high, its apical margin truncate. Front of moderate breadth, middle interocular distance from .57 to .64 × transfacial distance. Middle interocular distance from 1.05 to 1.15 × lower interocular distance; upper interocular distance from .95 to 1.1 × the lower. Ocelli forming a right angle or slightly greater in front, post-ocellar line and ocello-ocular line subequal, or either somewhat the greater. First 4 antennal segments in a ratio of about 3:1:3:3.2; scape less than twice as long as its greatest thickness; segment 3 about twice as long as its greatest thickness; segments 9 to 12 each about twice as long as thick (fig. 63). Temples not strongly developed, the head contracted almost immediately behind the eyes. (Fig. 51, dorsal view.)

Pronotum varying from arcuate to feebly angulate behind. Propodeum slightly more declivous behind, without a median groove. Longer spurs of hind tibiae about .8 the length of the hind basitarsi. Venation as in the female. Abdomen cylindrical, slightly flattened dorsally, the apical segments as described under the generic heading.

Biology.—This species is active in the northeastern United States from May until September (farther south from April to October) but is most common in mid-summer; there are probably two or more generations a year. It occurs in sand or gravel banks, gardens, or sometimes even in open woodland where the soil is light. The nest is a burrow in the ground, and is provisioned with at least two species of epeirid spiders (*Metepeira labyrinthea* Hentz and *Epeira foliata* Fourcroy). The only account of its prey and habits is that of the Peckhams (1898).[42] Both sexes come frequently to many kinds of flowers, but especially to Umbelliferae; the following flowers are known to be visited: *Pastinaca sativa, Daucus carota, Cicuta maculata, Ceanothus* spp., *Polygonum cuspidatum, Solidago* spp., *Angelica, Melilotus alba, Baccharis salicina, Ptelea trifoliata,* and *Chaerophyllum teinturieri.*

Distribution.—This form occurs throughout North America east of the Rockies, from Texas and Florida to Northwest Territories and Labrador; west of the eastern slopes of the Rockies, and also in the Black Hills of South Dakota and places in Alberta, it is replaced by subspecies *californicus* Banks.

Specimens seen: 503 (312 ♀♀, 191 ♂♂). The following records are marginal: Nova Scotia: 3 ♀♀, 2 ♂♂, Baddeck, Cape Breton Isl., 5 Aug. [MCZ]; Prince Edward Island: 2 ♀♀ 1 ♂, Canad. Nat. Park, July-Aug. [CNC]; Labrador: 2 ♀♀, Goose Bay, 23-29 Aug. [CNC]; Quebec: 1 ♂, Kazabazua, 30 June [CNC]; Ontario: 1 ♂, Norway Point, Lake of Bays, June [CNC]; Michigan: Cheboygan Co., 1 ♀, Mullet Lake, 10 Aug. [Minn.]; Minnesota: Cook Co., 5 ♀♀, 1 ♂, June-Aug. [Minn.]; Manitoba: 1 ♂, Cormorant Lake, July [CNC]; Saskatchewan: 1 ♂, Prince Albert, July [CNC]; Northwest Territories: 1 ♀, Fort Norman, McKenzie River, 6 Aug. [CNC]; Alberta: 2 ♀♀, White Mud R., Peace River Dist., 22 July [CNC]; Montana: 1 ♀ (no further data) [ANSP]; Colorado: 1 ♀ (no further data) [USNM]; Texas: Brewster Co., 1 ♂, Chisos Mts., 5 July [OSC]; Brazos Co., 1 ♀, 5 ♂♂, May-Oct. [JEG]; Florida: Pasco Co., 1 ♀, Elfers, 4 Apr. [KVK]; Orange Co, 1 ♀, Orlando, 8 Mch. [Mass.]

3b. **Episyron biguttatus californicus** (Banks)

Psammochares californica Banks, 1910, Jour. N. Y. Ent. Soc. 18: 117. [Type: ♂; Claremont, Calif. (Baker); M.C.Z. no. 13,664.]

Episyron californicus Banks, 1911, Jour. N. Y. Ent. Soc., 19: 230.--Banks, 1919, Bull. Mus. Comp. Zool., 63: 241.

Episyron arizonica Banks, 1933, Psyche, 40: 5. [Type: ♀; Apache Camp, Santa Catalina Mts., Ariz., 5500 feet, 25 July 1917 (J. Bequaert); M.C.Z. no. 17,033.] New synonymy.

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[42] Since the above was written I have, however, discovered a short account of the behavior of this wasp by Phil Rau (1922, Trans. Acad. Sci. St. Louis, v. 24, no. 7, pp. 9-10). The host in this case was *Epeira prompta* Hentz (=*Eustala anastera* Walck.). In two instances, Rau found the egg of the wasp to be attached firmly to the abdomen of the spider. This is contrary to other observations on wasps of this genus, and to the statement made by the present author on an earlier page that the egg is attached to the wall of the cell in this genus, and not directly to the spider.

This is an all black or somewhat blue-black western subspecies of *biguttatus,* paralleling the case of *quinquenotatus* and its subspecies *hurdi.* However, this is a wider-ranging form than *hurdi,* occurring east to New Mexico and the Black Hills of South Dakota. The males retain the whitish streak on the hind tibia and the white apical tergite.

FEMALE.—Length 13 (10–17) mm. Color black, the outer orbits very narrowly pale, the inner orbits sometimes with a very small pale spot; rarely there are a pair of pale spots on the 3d abdominal tergite. Wings wholly infuscated, somewhat deeper along the outer margin, distinctly violaceous. Body rendered rather conspicuously deep blue-black by the pubescence. Squamiform pubescence rather dark. Morphologically very similar to typical *biguttatus.* Eyes converging strongly above, upper interocular distance from .6 to .75 × lower interocular distance. Tarsal comb strong, the apical spine on the basitarsus usually slightly longer than the 2d tarsal segment.

MALE.—Length 9.5 (7–13) mm. Color black, the inner and outer orbits with small pale markings; apical abdominal tergite mostly whitish; hind tibia with a spot or usually a stripe of whitish on the outer side near the base. Pubescence dark blue-black as in the female, occasionally silvery on the lower front and parts of the thorax. Squamiform pubescence varying from dark to silvery. Wings subhyaline or lightly infuscated, the outer margin of the fore wing and apex of the hind wing with a darker band. Structurally not differing noticeably from the nominate subspecies.

Biology.—Like other members of the genus, this subspecies is a frequent visitor to flowers; it has been taken on *Cicuta, Eriogonum, Cleome,* and *Solidago.*

Distribution.—Upper Sonoran to Canadian faunas, from New Mexico, Arizona, and California to British Columbia, Alberta, and the Black Hills of South Dakota.

Specimens seen: 134 (87 ♀♀, 47 ♂♂). Marginal records are as follows: SOUTH DAKOTA: Custer Co., 13 ♀♀, 2 mi. So. of Custer, 24 Aug. [HEE, CU]; MONTANA: Lake Co., 1 ♀, Flathead Lake [USNM]; ALBERTA: 1 ♀, Waterton, 13 July [Alta.]; BRITISH COLUMBIA: 1 ♀, Revelstoke, Selkirk Mts., July [CU]; 1 ♀, Maple Bay, Vancouver Island, July [CNC]; CALIFORNIA: San Diego Co., 1 ♂, Warner Springs [UK]; ARIZONA: Pima Co., 1 ♀, Baboquivari Mts., 8 Aug. [CAS]; NEW MEXICO: Otero Co., 1 ♀, Alamogordo, 13 May [ANSP]; Santa Fe Co., 1 ♀, 9200 feet, Aug. [MCZ]; UTAH: Davis Co., 1 ♀, Bountiful, 8 Aug. [UAC].

4. Episyron oregon new species

(Plate XV, figs. 50, 53; plate XVI, fig. 64.)

This species is closely allied to the preceding, with which it has previously been confused; the males also closely resemble those of *quinquenotatus hurdi.* The diagnostic morphological features are the very broad front and vertex, the rather wide temples, the broad ocellar triangle, the front angle of which is much greater than a right angle, and the elevation of the vertex in an arc above the tops of the eyes. (Figs. 50 and 53.) The apical abdominal tergite of the male is black or only slightly suffused with pale. The females suggest *snowi,* but the body is much more hairy than in this species, and the pronotum shorter. *E. oregon* is an inhabitant of the northwestern United States and western Canada.

FEMALE (Holotype).—Length 9.5 mm.; fore wing 8.5 mm. Color black, the upper outer orbits with a very narrow pale yellowish stripe, the 3d abdominal tergite with a very small pale spot on each side. Wings lightly infuscated, the outer margins with a darker band, not violaceous. Entire body with a close brownish pubescence. Tergite 1, posterior slope of propodeum, postnotum, middle of metanotum, pronotum, and the mesopleura just below the tegulae with a dingy squamiform pubescence. Body with considerable dark, erect hair of moderate length: scape, clypeus, front, vertex, temples, propleura, front coxae, pronotum, mesopleura, metanotum, propodeum, and tergite 1 all with abundant hairs; remaining coxae and remainder of thoracic dorsum somewhat hairy, the femora barely so; apical abdominal segments with a few strong setae.

Head in anterior view (fig. 53) subcircular; transfacial distance 1.08 × facial distance. Clypeus 2.3 × as broad as high, its apical margin truncate, narrowly reflexed. Front very broad, middle interocular distance .67 × transfacial distance. Inner orbits subparallel below, distinctly converging above, upper interocular distance .75 × lower interocular distance. Vertex raised slightly, evenly and arcuately, above the tops of the eyes. Ocelli in a broad triangle, the front angle greater than a right angle; post-ocellar line and ocello-ocular line about equal. Antennae moderately long and slender, the first 4 segments in a ratio of 3:1:4.5:3.5, segment 3 equal to .82 × upper interocular distance. Temples strongly developed, in dorsal view nearly as thick as the eyes.

Pronotum shorter than the mesonotum, its posterior margin arcuate, with a faint median angulation. Postnotum strongly expanded on each side of the median line. Propodeum sloping more steeply behind, the declivity flat and somewhat polished; median line not impressed. Comb of front tarsus strongly developed, the spines slightly flattened and curved; basitarsus with 3 comb-spines, the apical one 1.3 × the length of the 2d tarsal segment.

Longer spur of hind tibia .7 the basitarsus. Venation as in *biguttatus* and in no way distinctive.

Nineteen female paratypes vary in length from 6.5 to 12 mm., the average being 9.5 mm. The usual color of the abdomen is wholly black; only occasionally are there small spots on tergite 3, and one specimen has paired spots on tergites 2 and 3. Middle interocular distance varies from .63 to .67 × transfacial distance; upper interocular distance varies from .75 to .81 × the lower; antennal segment 3 varies from .75 to .9 × upper interocular distance. The length of the comb-spines varies from 1 to 1.5 × the 2d tarsal segment.

MALE (Allotype).—Length 8.5 mm.; fore wing 8 mm. Color black, the upper outer orbits with a slender pale yellowish streak; body and legs wholly without other pale markings. Front wings lightly infuscated, darker along the outer margin; hind wings subhyaline, slightly darker apically. Entire body with a fine brownish pubescence; squamiform pubescence dingy, distributed as in the female. Scape hairy above and below; head, thorax, propodeum, and tergite 1 with abundant black pile of moderate length.

Head in anterior view subcircular, a little broader than high, transfacial distance 1.1 × facial distance. Vertex raised rather strongly, arcuately, above the tops of the eyes. Temples rather strong, in dorsal view (fig. 50) nearly as wide as the eyes. Clypeus twice as broad as high, its apical margin truncate. Front broad, middle interocular distance .65 × transfacial distance. Eyes diverging above, middle interocular distance 1.15 × the lower, upper interocular distance 1.05 × the lower. Antennae of moderate length, the first 4 segments in a ratio of 5:2:5:6, segment 3 about 1.5 × as long as thick; segments 9 to 12 each about 1.5 × as long as thick (fig. 64). Ocelli in a broad, flat triangle, post-ocellar line and ocello-ocular line about equal.

Pronotum short, its posterior margin distinctly angulate. Propodeum short, its median line lightly impressed. Apical tarsal segments not spined beneath. Longer spur of hind tibia .8 the basitarsus. Abdomen subfusiform, the dorsum slightly flattened; apical segments as described under the generic heading.

Fifteen male paratypes vary in length from 5.5 to 10.5 mm., the average being 7.5 mm. The apical abdominal tergite may be black or suffused with whitish; in none of the members of the type series is it as conspicuously whitish as in the other members of the genus. Middle interocular distance varies from .62 to .68 × transfacial distance. In other features they compare closely with the allotype.

Distribution.—Western United States and Canada, from Yukon and Alberta to Wyoming and California; principally a Transition Zone species.

Holotype.—OREGON: Klamath Co. ♀, Lamis Mill, Eagle Ridge, Klamath Lake, 24 May 1924 (C. L. Fox) [CAS]. *Allotype.*—CALIFORNIA: San

Benito Co. ♂, Pinnacles National Monument, 24 April 1948 (J. W. McSwain) [CAS].

Paratypes.—California: 1 ♀ (no further data) [ANSP]; San Luis Obispo Co., 1 ♀, Pismo, 25 Apr. 1919 (E. P. VanDuzee) [CAS]; Santa Cruz Co., 1 ♀, Felton, Santa Cruz Mts., 15–19 May 1907 (J. C. Bradley) [CU]; Los Angeles Co., 1 ♂, Santa Monica (F. C. Clark) [CAS]; Washington: 2 ♀♀, 2 ♂♂ (labeled "W. T."; no further data) [ANSP]; Wyoming: 3 ♀♀, 1 ♂, Summit, 8835 feet, 16 Aug. 1940 (H. E. Milliron) [Minn.]; Montana: 6 ♀♀, 7 ♂♂ (no further data) [ANSP, USNM, CU]; Alberta: 1 ♀, 1 ♂, Medicine Hat, 17 July 1917 (F. W. L. Sladen) [CNC]; 1 ♀, Tilley, 7 June 1941 (J. L. Carr) [Alta.]; 1 ♂, Gull Lake, 24 June 1929 (E. H. Strickland) [Alta.]; 1 ♂, Lethbridge, 30 May 1929 (J. H. Pepper) [CNC]; British Columbia: 1 ♀, 1 ♂, Vernon, 25 July 1917 (F. W. L. Sladen) [CNC]; 1 ♀, Vernon, 19 Aug. 1917 (M. H. Ruhmann) [CNC]; Yukon: 1 ♀, Whitehorse, 2 July 1948 (W. R. M. Mason) [CNC].

5. **Episyron snowi** (Viereck) (Plate XVI, fig. 66.)

Anoplius (Pompilinus) snowi Viereck, 1906, Trans. Amer. Ent. Soc., 32: 202. [Type: ♂; Morton Co., Kansas, 3200 feet (F. H. Snow); Univ. Kansas.]

Psammochares maneei Banks, 1910, Jour. N. Y. Ent. Soc., 18: 117. [Type: ♀; Southern Pines, N. C., 26 June 1909 (A. H. Manee); M.C.Z. no. 13,663.] New synonymy.

Episyron maneei Banks, 1911, Jour. N. Y. Ent. Soc., 19: 230.—Rau, 1922, Trans. Acad. Sci. St. Louis, v. 24, no. 7, p. 10. [Biology.]—Brimley, 1936, Jour. Elisha Mitchell Sci. Soc, 52: 121.—Brimley, 1938, Insects No. Carolina, p. 432.

Episyron laevus Banks, 1933, Psyche, 40: 4. [Type: ♀; Fedor, Lee Co., Texas, 27 Mch. 1909 (Birkmann); M.C.Z. no. 17,032.] New synonymy.

[?]*Episyron snowi* Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 121. —[?] Brimley, 1938, Insects No. Carolina, p. 433.

The name *snowi* has seldom been used in its correct sense. The type, which I have examined, is in good condition, and there can be no doubt of its association with Banks' *maneei.* This is the most highly evolved of our native species of the genus, as evidenced by the loss of erect hair in the female, the rather long pronotum, the short antennae, the segments of which are somewhat imbricate in the male, and the often very extensive squamiform pubescence.

Female.—Length 10.5 (8–13) mm.; color black, the upper outer orbits usually with a very small pale spot or stripe. Pubescence brownish or obscurely metallic, often silvery on the lower front and clypeus. Squamiform pubescence brownish-silvery or somewhat coppery in color, usually more extensive than in other members of the genus, covering not only the first abdominal tergite, but usually parts of the 2d, and sometimes extending onto the 3d, 4th, and even the 5th tergites; pronotum and propodeum extensively clothed with scales, and to a lesser extent the meso- and metapleura, hind coxae, sides of the scutellum, postnotum, and metanotum. In specimens which have flown for some time, much of this squamiform pubescence may be lost. Scape not or very barely hairy; front and vertex with only some inconspicuous hair; pronotum, mesopleura, propodeum, and base of tergite 1 with only some very inconspicuous, short, pale hairs; apical abdominal segments with a few dark setae. Fore wings nearly hyaline basally, becoming gradually more infuscated apically, the outer margin with a dark band; hind wings subhyaline, infuscated apically.

Head in anterior view subcircular, the vertex raised rather noticeably above the tops of the eyes. Clypeus about 2.4 × as broad as high, its apical margin truncate, narrowly reflexed. Front broad, middle interocular distance from .61 to .65 × transfacial distance. Inner orbits subparallel below, distinctly converging above the middle, upper interocular distance varying from .75 to .8 × lower interocular distance. Ocelli in a flat triangle well below the crest of the vertex, the front angle greater than a right angle; post-ocellar line is to ocello-ocular line about as 5:3. Antennae relatively short for the genus, the first 4 segments in a ratio of about 3:1:5.3.5, segment 3 from .8 to .9 × upper interocular distance. Head thin, contracted immediately behind the eyes, the temples not well developed.

Pronotum rather long, subequal in length to the mesonotum, its posterior margin arcuate. Propodeum sloping gradually in front, with a rather abrupt, oblique, slightly concave declivity on the posterior third. Front tarsus with a comb of long, slender spines; there are 3 comb-spines on the basitarsus, the apical one from 1.2 to 1.5 × the length of the 2d tarsal segment. Legs strongly spinose; middle and hind femora compressed. Wing venation of the usual type in the genus; marginal cell slightly more than its own length from the wing-tip.

MALE.—Length 8 (6–10.5) mm. Color black, or very deep blue-black, more or less marked with white or very pale buff; mandibles tricolored, the base black, the middle white, the apex reddish; upper outer orbits and often the middle inner orbits very narrowly pale; pronotum occasionally with a band of pale along its posterior margin; apical abdominal tergite, a streak along the outer side of the hind tibia, and the spurs of the middle and hind tibia, whitish; front tibial spurs dusky white or yellowish; apex of front tibiae with a pale spot; scape often with a small pale spot apically. Wings hyaline, with a conspicuous whitish bloom, the outer margins banded with fuscous. Body clothed with a somewhat coarse pubescence, silvery at least on the clypeus, front, and lower sides of the thorax, often more extensively silvery. Squamiform pubescence very coarse, dense, whitish, distributed much as in the female though because of its color and density it is much more conspicuous than in that sex. Scape, clypeus, front, vertex, temples, and prothorax with considerable erect, short, mostly whitish hair;

remainder of thorax, propodeum, and tergite 1 with a variable amount of inconspicuous pale hair.

Clypeus about twice as broad as high, truncate below. Front of variable breadth, middle interocular distance from .6 to .67 × transfacial distance. Eyes diverging above, middle interocular distance about 1.25 × the lower, the upper about 1.15 × the lower. Ocelli in a broad triangle, post-ocellar line is to ocello-ocular line about as 5:4. Head flat behind the eyes, the temples reduced; malar space fairly long, nearly as long as the antennal pedicel. Antennae relatively short and thick; first 4 segments in a ratio of about 6:2:5:6; segment 3 less than 1.5 × as long as thick; segments 9 through 12 each less than 1.5 × as long as thick; there is a slight constriction between each of the flagellar segments, and on the outside each segment may be seen to be somewhat produced dorsally so as to overlap part of the next segment (fig. 66).

Pronotum rather long, almost or quite as long as the mesonotum, its posterior margin arcuate or very feebly angulate. Middle and hind legs very long, slender, and strongly spinose; longer spur of hind tibia nearly as long as the basitarsus. Abdominal characters of the usual form in the genus.

Biology.—This species is usually taken on flowers, and has been taken on *Stillingia, Gossypium, Solidago, Baccharis, Tamarix,* and *Polytaenia nuttallii.*

Rau (1922) discovered a female of this species walking across a road and into a woods dragging the epeirid spider *Cyclosa conica* (Pallas).

Distribution.—This species occurs transcontinentally in the Lower and Upper Austral Zones, north to New Jersey, Illinois, South Dakota, Montana, and Oregon. It appears to be somewhat less uncommon westward, and is sometimes taken in series on flowers in desert areas.

Specimens seen: 102 (42 ♀♀, 60 ♂♂). The following records are marginal or from areas where the species is local in occurrence, or where its distribution may be discontinuous: NEW JERSEY: Camden Co., 1 ♀ [USNM]; NORTH CAROLINA: Dare Co., 3 ♀♀, Kill Devil Hills, 28–30 May [KVK]; Moore Co., 3 ♀♀, 1 ♂, Southern Pines, June-Nov. [MCZ, CU]; GEORGIA: Schley Co., 1 ♂, Ellaville, 28 Apr. [USNM]; ILLINOIS: Morgan Co., 1 ♂, Meredosia, 22 Aug. [OSC]; IOWA: Woodbury Co., 1 ♀, 1 ♂, Sioux City, June [USNM]; SOUTH DAKOTA: Harding Co., 1 ♂, Buffalo, 31 July [SDS]; Custer Co., 1 ♀, Custer, 24 July [Minn.]; MONTANA: 1 ♀, 1 ♂ (no further data) [ANSP]; IDAHO: Gooding Co., 1 ♀, Hagerman, 9 Sept. [USNM]; WASHINGTON: Yakima Co., 3 ♂♂, Yakima R., June [MCZ]; CALIFORNIA: Contra Costa Co., 1 ♀, 1 ♂, Antioch, Apr., Aug. [CIS, CAS]; San Diego Co., 1 ♂, 23 Aug. [CAS]; ARIZONA: Cochise Co., 2 ♂♂, Douglas, 16 June [OSC, CAS]; NEW MEXICO: Otero Co., 1 ♂, White Sands, 30 June [UK]; TEXAS: El Paso Co., 1 ♀, 6 ♂♂, June [OSC]; Cameron Co., 1 ♀, 6 ♂♂, Brownsville, May [USNM]; LOUISIANA: 1 ♂ (no further data) [USNM]; ALABAMA: 1 ♂ (no further data) [USNM]; FLORIDA: Hillsborough Co., 1 ♂, Lutz, 20 Mch. [CM].

VII. Genus **POECILOPOMPILUS** Howard

Poecilopompilus Howard, 1901, The Insect Book, pl. V, fig. 1, and pl. XI, fig. 18. [Type: *Pompilus navus* Cresson, 1867 (= *interruptus interruptus* Say, 1835); designated by Ashmead, 1902.]—Ashmead, 1902, Canad. Ent., 34: 82. [Proposed as new genus.]

Batozonus Howard, 1901, The Insect Book, pl. XI, fig. 24. [Type: *Pompilus algidus* Smith, 1855; monobasic.] New synonymy.—Ashmead, 1902, Canad. Ent., 34: 81. [Proposed as new genus.]

Agenioxenus Ashmead, 1902, Canad. Ent., 34: 137. [Type: *Ceropales rufiventris* Ashmead, *nec* Walsh (misidentification) (= *interruptus interruptus* Say, 1835); monobasic.] [43]

Batazonus Banks, 1911, Jour. N. Y. Ent. Soc., 19: 221, 224. [*Lapsus calami* for *Batozonus* Howard, 1901.]—Dreisbach, 1949, Ent. Amer. (n.s.) 29: 5, 8, 38, pl. III, fig. 12.

This is one of the most distinctive genera of Pompilini. The upper margin of the clypeus is strongly sinuate; the eyes of the female are strongly convergent above; the postnotum is much expanded on each side of the median line, where it is often concealed; the front tibiae are spinose above; the anal vein of the hind wing meets the media well beyond the origin of the cubitus. Most of the species are brightly colored, some of them suggesting species of *Polistes*.

Generic characters.—Small to fairly large wasps (8–28 mm.); color black and/or ferruginous, often marked with yellow. Body with a variable amount of erect hair; apical abdominal segment of female with numerous strong setae, but none of them bristly.

Maxillary palpi relatively short, segments 4 through 6 each considerably shorter than 3. Labrum semicircular, its apical margin bristly, with a slender median incision; labrum protruding slightly from beneath the clypeus, in the male sometimes a considerable distance. Mandibles bidentate in the female, unidentate in the male. Disc of clypeus somewhat

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[43] For an amusing sidelight on the question of the identity of *Agenioxenus* Ashmead, see Ashmead's paper "*Ceropales* vs. *Agenioxenus*" (1902, Ent. News, 13: 318). Dr. Ashmead's specimen of *Ceropales rufiventris* Walsh (= *robinsoni* Cresson) was a misidentified male *Poecilopompilus interruptus* (Say). This is apparent from his description and remarks, and is confirmed by Rohwer (see Banks, 1911, Jour. N. Y. Ent. Soc., 19: 220). The invective leveled by Ashmead against Viereck in the above paper is certainly out of order!

convex; fronto-clypeal suture with a strong sinuation on each side. Malar space very short or practically absent. Inner orbits converging above, in the female rather strongly so. Antennae of moderate length; scape of male short, not twice as long as its greatest thickness; outer flagellar segments of the male somewhat convex below, concave above, the profile thus slightly crenulate.

Pronotum short, expanded gradually from front to rear, the slope smooth and even, the median line usually faintly impressed. Postnotum of variable length, but always strongly constricted medially, where it may be concealed by the overhanging metanotum, and constricted again just above the spiracles, the hind margin arcuately expanded on each side of the median line, between the constrictions (fig. 70). Propodeum either with even contours, or somewhat protuberant postero-laterally. Legs long and spinose; femora with numerous minute spines; front tibiae spinose above for most of their length, and unusually spinose on the sides; front tarsus of female with a tarsal comb. Apical tarsal segments spined beneath in the female, often weakly so in the male. Pulvillar pad small; pulvillar comb consisting of 6 to 8 weak, diverging setulae. Claws of the female dentate, except that in some species those of the front tarsus are bifid; claws of the male all bifid, the inner ray truncate; front claws of male alike, the apical segment of this tarsus unmodified.

Wings long; fore wings with a vena spuria above the media along which the wings sometimes fold longitudinally, although this tendency is less strong than in *Episyron*. Stigma small or of moderate size; marginal cell long and slender, its apex acute; 2d and 3d submarginal cells both 4-sided, wide above; 3d discoidal cell less than its own length from the wing margin. Hind wing with the submedian cell very long and slender, the anal vein meeting the media well beyond the origin of the cubitus. The venation does not differ greatly from that of *Episyron*.

Abdomen of female rather stout, subfusiform, in some species rather slender basally. Abdomen of male slender, in cross-section subtrigonal, the dorsum flattened. Sternite 6 with a U-shaped emargination. Subgenital plate strongly elevated medially, the apex rounded, the plate shaped much as in *Episyron*. Genitalia (figs. 43 and 44) with the aedoeagus somewhat bilobed apically, sometimes with a few weak setae along the shaft; parapenials slender, simple; basal hooklets double; digiti subspatulate, the disc with numerous short, downward-directed setae; parameres slender and simple.

Biology.—Wasps of this genus, as in the closely related *Episyron*, appear to prey entirely upon orb-weavers (Epeiridae). The habits of a Central American species in capturing and transporting its prey are described by Thomas Belt as follows:

"I one day saw a small black and yellow banded wasp (*Pompilus polistoides*) [i.e., *Poecilopompilus polistoides* (Smith)] hunting for spiders; it approached a web where a spider was stationed in the centre, made a dart towards it—apparently a feint to frighten the spider clear of its web; at any rate it had that effect, for it fell to the ground, and was immediately seized by the wasp, who stung it, then ran quickly backwards, dragging the spider after it, up a branch reaching to the ground until it got high enough, when it flew heavily off with it. It was so small, and the spider so heavy, that it probably could not have raised it from the ground by flight . . . ."[44]

Whether these same behavior patterns occur throughout the genus remains to be determined; quite likely they do. A few notes are available concerning the habits of our native *interruptus,* and these are summarized under that species. Members of this genus are very frequent visitors to flowers of many kinds.

Distribution.—This genus is characteristic of the American tropics, but ranges as far south as Argentina and Bolivia, and as far north as California, North Dakota, southern Ontario, and New England. Old World species placed in the past in the genus *Batozonus* all belong (to the best of my knowledge) to the very closely related genus *Batozonellus* Arnold. Many species belonging to this genus have been described from the Americas, but in actuality there are but a few widely distributed, polytypic species. In our fauna there are two polytypic species.

Key to Species

Females

1. Claws of front tarsus bifid, the inner ray truncate; front basitarsus with 3 rather strong comb-spines; eyes strongly convergent above, upper interocular distance not much more than half lower interocular distance; antennal segment 3 about 1.3 × upper interocular distance (*algidus*) 2

   All the claws dentate, the tooth erect, acute; front basitarsus with 4 shorter comb-spines; eyes less strongly convergent above, upper interocular distance from .65 to .75 × the lower; antennal segment 3 subequal to or a little greater than upper interocular distance (*interruptus*) 4

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[44] Belt, Thomas, 1874, The Naturalist in Nicaragua, pp. 133–134.

2. Posterolateral corners of propodeum roundly protuberant; wings wholly dark fuliginous, strongly violaceous; general body color varying from deep castaneous to black, the 3d abdominal tergite with contrasting orange markings; body wholly without yellow markings; flagellum blackish .... 1a. **algidus algidus** (Smith)

   Propodeum with nearly even contours, not or barely protuberant posteriorly; wings varying from brownish tinged with yellowish in the costal or marginal cells to almost wholly flavous; body color lighter, and always marked with at least a little yellow along the posterior margin of the pronotum; postero-lateral corners of the propodeal rim usually yellow; metanotum often marked with yellow; basal 3 or 4 segments of flagellum ferruginous or yellowish 3

3. Wings rather uniformly brownish or yellow-brown, somewhat luteous along the costal or marginal cell, slightly violaceous; body generally rich ferrugino-castaneous, tergite 3 and sometimes tergites 4–6 more or less marked with yellow .... 1b. **algidus marcidus** (Smith)

   Wings bright flavous, the outer margins with a distinct narrow fuscous band, not at all violaceous; at least the thoracic pleural sutures blackish, more often a large part of the thorax and tergite 1 suffused with blackish; abdomen beyond the basal segment more or less yellowish
   1c. **algidus coquilletti** (Provancher)

4 Head and thorax liberally marked with yellow and usually with ferruginous or castaneous; mesonotum rarely wholly black; posterior slope of propodeum almost always with a transverse yellow band, or the propodeum mostly yellow; coxae never wholly black; abdomen variously colored, usually conspicuously banded
   2a. **interruptus interruptus** (Say)

   Head, thorax, and propodeum mainly black, with limited yellow markings; mesonotum black; propodeum rarely with more than the lateral corners of the rim yellow; coxae black; abdomen blackish or dusky ferrugino-castaneous, not usually noticeably banded
   2b. **interruptus cressoni** (Banks)

Males

1. Clypeus about 2.3 × as broad as high, its apical margin broadly rounded; eyes very broad, only about 1.5 × as high as their greatest breadth; middle interocular distance about .56 × transfacial distance; aedoeagus broadly bilobed apically (*algidus*) 2

   Clypeus about twice as broad as high, its apical margin truncate; eyes less broad, about 1.8 × as high as their greatest breadth; front proportionally broader, middle interocular distance about .61 × transfacial distance; aedoeagus narrowly bilobed apically (*interruptus*)
   See couplet 4 of key to females

2. Propodeum steeply declivous behind, the sides of the declivity roundly protuberant; wings wholly deep fuliginous, violaceous; body color varying from dark castaneous to black, tergite 3 more or less marked with orange at the base; body without yellow markings
1a. **algidus algidus** (Smith)

Propodeum less steeply declivous behind, the sides scarcely protuberant; wings with at least a little yellowish along the costal margin, sometimes in large part yellowish; colors, at least in part, paler; lateral corners of propodeal rim, posterior margin of pronotum, and usually spots on the metanotum and scutellum, yellow 3

3. Wings darker, varying shades of yellow-brown, brownish-hyaline, or fuscous, somewhat luteous along the costal margin; thorax mostly pale, the mesonotum at most in small part blackish; abdomen wholly more or less pale, the tergites usually with darker posterior margins
1b. **algidus marcidus** (Smith)

Wings flavous or bright yellow-brown, the outer margins with a fuscous band; thorax, propodeum, and basal one or two abdominal segments more or less suffused with blackish; mesonotum almost wholly blackish; abdominal segments 3–7 more or less yellowish, contrasting with the darker basal segements ....1c. **algidus coquilletti** (Provancher)

1a. **Poecilopompilus algidus algidus** (Smith) new combination
(Plate XIV, fig. 43; plate XVI, fig. 70)

Pompilus algidus F. Smith, 1855, Cat. Hymen. Brit. Mus., III, p. 158 [Type: ♀; "North America"; British Museum (not seen by author)]—Cresson, 1867, Trans. Amer. Ent. Soc., 1: 101. [W. Va., Ga.]—Cresson, 1872, Trans. Amer. Ent. Soc., 4: 203. [Texas.]—Dalla Torre, 1897, Cat. Hymen., VIII, p. 271.—Birkmann, 1899, Ent. News, 10: 244. [Lee Co., Texas.]

Batozonus algidus Howard, 1901, The Insect Book, pl. XI, fig. 24.—Ashmead, 1902, Canad. Ent. 34: 81.—Regan, 1923, Ann. Ent. Soc. Amer., 16: 183, 191.

Anoplius algidus J. Smith, 1910, Ann. Rpt. N. J. State Mus., 1909, p. 674.

Batazonus algidus Banks, 1911, Proc. Ent. Soc. Wash., 13: 238.

Arachnophroctonus ferrugineus Dreisbach, 1949, Ent. Amer., (n.s.) 29: 40, pl. IV, fig. 17. [*Nec* Say; misidentification.]

This large spider wasp is not easily confused with any other, as its generic, specific, and subspecific characteristics are all very distinctive. *Algidus* and its subspecies are far less commonly met with than *interruptus,* though nearly as widely distributed.

FEMALE.—Length 22 (17–28) mm.; color somewhat variable, the ground color generally very deep ferruginous or mahogany-brown, sometimes practically black over the greater part of the body; tergite 3 at base with two semicircular orange spots, which may be united to form a band which is emarginate behind. Antennae black beyond the 3d segment, the first 3 segments black or dark brown; head varying from mostly brownish, but blackish around the ocelli and antennal bases, to wholly blackish with brownish blotches on the upper inner orbits; legs varying from castaneo-ferruginous through brown to black; tegulae usually brownish, contrasting with the darker mesonotum. Wings deep fuliginous, strongly violaceous. Body clothed with a somewhat velvety pubescence, brownish or more or less violaceous, lighter if and wherever the integument is lighter. Front with dense short hair just above the antennal bases, its color depending upon that of the integument; temples and propleura with dense, fine hair; vertex, pronotum, front coxae, mesopleura, metanotum, and propodeum all with considerable rather fine hair.

Clypeus large, about 2.3 × as broad as high, almost touching the eyes on each side, the apical margin truncate, the basal margin strongly sinuate. Front broad below, greatly narrowed above by the convergence of the eyes; middle interocular distance about .9 × the lower; upper interocular distance about .55 × the lower; middle interocular distance about .53 × transfacial distance; lower interocular distance about .6 × transfacial distance. Eyes broad, their height about 1.8 × their greatest width. Vertex raised arcuately above the tops of the eyes. Ocelli below the vertex crest, and just below a line drawn between the eyes at their point of nearest proximity; ocelli in a close, flat triangle; post-ocellar line is to ocello-ocular line about as 5:4. There is a faint groove from the hind ocelli to the eye margins. Antennae of moderate length, the first 4 segments in a ratio of about 4:1:8:5, segment 3 equal to about 1.3 × upper interocular distance.

Pronotum very short, its posterior margin broadly angulate. Postnotum without striations, overhung medially by the very convex metanotum (fig. 70). Propodeum short, its median line weakly impressed above; slope, in profile, somewhat steepened behind; postero-laterally the propodeum is roundly protuberant on each side; posterior rim sharply rectangular postero-laterally. Front tarsus with a comb of blade-like spines; there are 3 comb-spines on the basitarsus, the apical one subequal in length to the 2d tarsal segment. Apical tarsal segments with a row of from 5 to 8 small spines beneath. Claws of the front tarsus bifid, the inner ray truncate; remaining claws dentate, the tooth short, erect, acute. Fore wing with the marginal cell long, the radial vein evenly arched; 1st transverse cubital vein strongly arched; the 2d nearly straight; the 3d straight or slightly arched.

MALE.—Length 16 (13–21) mm. Color varying from dark castaneous to black, with an area of pale castaneous or orange on the 3d abdominal segment, which may consist of paired semicircular spots near the base of the tergite, or a band, which may in some cases encircle the entire segment; this is, of course, less conspicuous when the entire insect is brownish, but very evident when it is black. The legs and antennae vary like the body from castaneous to black; the tegulae and inner and outer orbits are always brownish; there is no yellow on the body except sometimes a faint indication of it on the posterior pronotal margin. Wings uniformly fuliginous, strongly violaceous. Pubescence pale or dark, depending on the color of the integument, rather iridescent; erect hair of the body much as in the female.

Head much broader than high, transfacial distance 1.3 × facial distance (this is measured exclusive of the labrum, which is normally well exserted). Clypeus separated from the eyes on each side by a very narrow strip; clypeus 2.3 × as broad as high, its apical margin rounded. Front broad, but because of the width of the eyes, middle interocular distance is only about .56 × transfacial distance. Middle interocular distance about equal to the lower; the upper about .85 to .9 × the lower. Ocelli located below the vertex crest, in a small, flat triangle; post-ocellar line is to ocello-ocular line about as 2:3. Scape small, the flagellum long and heavy, the segments except the first and last concave above and convex below; first 4 antennal segments in a ratio of about 7:2:13:11, segment 3 about 2.3 × as long as thick and this segment alone equal to slightly over half the upper interocular distance. Eyes very broad, each about 1.5 × as high as broad.

Pronotum short, much broadened behind, its posterior margin angulate. Scutellum and metanotum very convex, the latter overhanging the postnotum on the median line. Propodeum short, steeply and broadly declivous behind, the posterolateral angles somewhat protuberant; propodeum also with small humps in front of the spiracles. Legs long, spinose; longer spur of hind tibia about .6 the basitarsus. Venation as in the female.

Abdomen stout, decidedly flattened dorsally; first and second tergites very broad, the abdomen tapering thereafter. Sternite 6 with a broad, rather shallow emargination; subgenital plate in profile with the median elevation very slightly arcuate. Genitalia (fig. 43) with the aedoeagus slender, the apex broadly flabellate; parapenials rather stout, a little shorter than the aedoeagus; basal hooklets double, often with some indication of a third tooth between the usual two; digiti rather variable in shape, subspatulate, clothed only with some very small, inconspicuous setae, which are absent from the inner margin; parameres slender, the outer side with numerous small setae, the inner side with a few setae near the base.

Biology.—This form is usually taken on flowers; it is known to visit *Cicuta maculata, Polytaenia nuttallii* (Umbelliferae), *Ampelopsis arborea* (Vitaceae), and *Euphorbia marginata* (Euphorbiaceae). No information is available regarding the host spiders of this species; I assume it preys upon large orb-weavers.

Distribution.—Typical *algidus* occurs throughout the Austroriparian and Carolinian faunas of the eastern United States, from eastern Texas and Florida to North Dakota, Michigan, and Massachusetts.

Specimens seen: 88 (55 ♀♀, 33 ♂♂). The following records are marginal: Massachusetts: Bristol Co., 1 ♂, Taunton [MCZ]; Connecticut: Litchfield Co., 1 ♀, Colebrook [MCZ]; New London Co., 2 ♀♀, Lyme, Aug. [USNM]; New York: New York City, 1 ♀ [ANSP]; New Jersey: Burlington Co., 1 ♀, Browns Mills, 28 June [ANSP]; Maryland; Charles Co., 4 ♀♀, Indian Head, Aug. [USNM]; Virginia: Nelson Co., 1 ♀, 21 Aug. [USNM]; West Virginia: 1 ♀ [ANSP]; Michigan: Midland Co., 1 ♂, 23 July [MCZ]; Minnesota: Chisago Co., 1 ♀, 10 ♂♂ [Minn.]; North Dakota: Traill Co., 1 ♀, 19 July [Minn.]; South Dakota: Lincoln Co., 1 ♀, Canton, 27 Aug. [SDS]; Iowa: Woodbury Co., 2 ♂♂, Sioux City [USNM]; Texas: Denton Co., 2 ♀♀, Shiloh, 4-8 Oct. [JEG]; Bexar Co., 1 ♀, 18 June [JEG]; Harris Co., 1 ♀, Houston, 11 Aug. [KVK]; Louisiana: Cameron Co., 1 ♀, Johnsons Bayou, 27 July [USNM]; Alabama: 1 ♀, Mobile, Aug. [CU]; Florida: Pinellas Co., 1 ♀, Gulfport, Sept. [MCZ].

1b. **Poecilopompilus algidus marcidus** (Smith) new combination

Pompilus marcidus Smith, 1862, Journal Ent., 1: 395–396. [Type: ♀; Orizaba, Mexico; British Museum (not seen by author).]—Cresson, 1867, Trans. Amer. Ent Soc., 1: 110.—Cresson, 1869, Proc. Boston Soc. Nat. Hist., 12: 371.—Cameron, 1893, Biol. Centr.-Amer., Hymen. II, p. 211.—Dalla Torre, 1897, Cat. Hymen., viii, p. 300.

Pompilus willistoni Patton, 1879, Bull. U. S. Geol. Survey, 5: 352. [Type: ♀; Northwestern Kansas, 8 Sept. 1877 (S. W. Williston); location of type unknown, possibly no longer extant.]—Dalla Torre, 1897, Cat. Hymen., viii, p. 336.

Batazonus marcidus Banks, 1925, Bull. Mus. Comp. Zool., 67: 338. [Panama].

Batozonus marcidus Bradley, 1944, Notulae Naturae, Acad. Nat. Sci. Phila., no. 145, p. 10.

Batazonus willistoni Banks, 1944, Bull. Mus. Comp. Zool., 94: 168.

The much paler coloration at once separates this subspecies from typical *algidus;* the propodeum is smooth, at most very slightly protuberant posterolaterally; the wings are brownish tinged with luteous toward the costal margin, never deep fuliginous or bright yellowish as in the preceding and following subspecies. I have relatively little material of this subspecies before me, but specimens from western Kansas and Colorado appear to differ little from specimens from Arizona, and from Mexico and Guatemala. For this reason I have placed Patton's *willistoni* in synonymy with the Mexican and Central American *marcidus* Smith. Judging from the description, Patton's type may have been an intermediate between this form and typical *algidus;* it is clear, however, that it is an *algidus,* and not an *interruptus,* as suggested by Banks (1944).

FEMALE.—Length 19 (17–22) mm., averaging slightly smaller than the nominate subspecies. Head castaneous, except the tips of the mandibles black, some black in the ocellar triangle, and usually some black near the antennal bases or base of the clypeus; lower front often suffused with yellowish; antennae castaneous or yellowish, except the apical 4 to 6 segments, which are black. Thorax, propodeum, and legs mostly castaneous, often somewhat blackish on the anterior part of the mesonotum, the postnotum, and along the pleural sutures; posterior margin of pronotum and lateral corners of propodeal rim yellowish; tibiae and tarsi sometimes suffused with yellowish. Basal two segments of abdomen castaneous, somewhat blackish along their posterior margins; tergite 3 with basal yellowish markings, the abdomen caudad of this either yellowish or pale castaneous, or a mixture of the two. Wings wholly brownish-fuscous, slightly violaceous, suffused with yellowish along the costal margin, often somewhat paler in the vicinity of the 3d discoidal cell; outer margins of wings banded with fuscous. Pubescence of body very light, silvery or somewhat golden, inconspicuous; erect hair also pale.

Features of the head much as in typical *algidus*; eyes about twice as high as their greatest breadth; 3d antennal segment from 1.3 to 1.5 × upper interocular distance. Thorax, including the legs and the venation, as in the typical subspecies. Propodeum with the slope low and even, scarcely or not at all protuberant on the sides of the posterior slope; surface not or very slightly elevated in front of the spiracles.

MALE.—Length 15 (13–17) mm. Head castaneous, often suffused with yellowish below; tips of mandibles black, front with a large black median blotch above, separated from the eyes on each side, extending from the ocellar triangle nearly to the antennal bases, with a pale spot in the center, just in front of the anterior ocellus; antennae castaneous, except segments 8 to 13, which are infuscated, the tip of segment 13 reddish-brown. Thorax, legs, and propodeum mostly castaneous; posterior margin of pronotum, metanotum, usually the scutellum, and spots on the corners of the propodeal rim, yellow; tegulae and sometimes a small part of the mesonotum yellowish; there is a variable amount of black on the front part of the mesonotum, the postnotum, the pleura, especially along the stutures, and sometimes also on the propodeum, the scutellum, and bases of the legs. Basal one or two segments of abdomen castaneous, the tergites darker behind; remainder of abdomen varying from pale castaneous to yellow, or a mixture of the two. Wings brownish-fuscous to brownish-hyaline, the outer margins narrowly fuscous, the costal margin tinged with yellowish, the wing somewhat paler in the vicinity of the 3d discoidal cell. Pubescence as in female. Front with a patch of short, pale hairs just above the antennal bases, and another on the vertex; pronotum and mesopleura with considerable short, pale hair;

propodeum with considerable longer hair. Morphological features as in the nominate subspecies, except for the propodeum, which has much more even contours, being very barely protuberant at the sides of the posterior slope.

Biology.—I have taken this subspecies on the flowers of *Cleome serrulata* (Capparidaceae), *Clematis* (Ranunculaceae), and *Avicennia nitida* (Verbenaceae); it has also been taken on *Ptelea trifoliata* (Rutaceae), and pollenia on the tarsi of several specimens indicate that it also visits *Asclepias.*

Distribution.—This form occurs from Central America north to southern and western Texas, the western parts of Kansas, Nebraska, and South Dakota, eastern Colorado, New Mexico, and southern Arizona.

Specimens seen: 26 (14 ♀♀, 12 ♂♂). TEXAS: Bexar Co., 3 ♀♀, 2 ♂♂, Sept.-Oct. [JEG]; Bastrop Co., 1 ♀, 1 ♂, Apr., Sept. [JEG]; Cameron Co., 1 ♂, Port Isabel, 23 June [HEE]; KANSAS: 1 ♀ (no further data) [UK]; NEBRASKA: 2 ♀♀ (no further data) [MCZ]; Thomas Co., 1 ♂, Halsey, 3 Sept. [Minn.]; SOUTH DAKOTA: Beadle Co., 1 ♀, Huron, 20 Aug. [SDS]; Brule Co., 1 ♂, Chamberlain, 31 Aug. [SDS]; COLORADO: Larimer Co., 2 ♂♂, Poudre Canyon, 5200 feet, 21 Aug. [HEE]; NEW MEXICO: McKinley Co., 1 ♂, Fort Wingate, 8 Aug. [ANSP]; ARIZONA: Southern part, 2 ♂♂ [MCZ, UK]; Cochise Co., 1 ♀, Carr Canyon, Huachuca Mts., 7 Aug. [CIS]; 1 ♀, 8 mi. No. of Douglas, 30 July [OSC]; Pima Co., 1 ♀, Baboquivari Mts., Oct. [CAS]; 1 ♂, Santa Rita Mts., 11 Aug. [JEG]; 1 ♀, Sabino Canyon, Santa Catalina Mts., 23 Aug. [CU]; MEXICO: 1 ♀ (no further data) [ANSP]; NICARAGUA: 1 ♀, Coseguina, 6 July [CAS].

1c. **Poecilopompilus algidus coquilletti** (Provancher) new combination

Pompilus coquilletti Provancher, 1889, Faune Ent. Canad., Hymen., Add. & Corr., p. 261. [Type: ♂; Anaheim, Calif. (Coquillett); Q.P.M. white label no. 27, yellow label no. 1422.][45]

Anoplius (*Batozonus*) *algidus* "Race?" Viereck, 1906, Trans. Amer. Ent. Soc., 32: 232. [Oak Creek Canyon, Ariz.]

Batazonus coquilletti Rohwer, 1916, Canad. Ent., 48: 372.

Batazonus flavipennis Banks, 1921, Ann. Ent. Soc. Amer., 14: 20. [Type: ♀; Salt Lake City, Utah; M.C.Z. no. 13,660.] New synonymy.

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[45] There is a second "type" of this species in the U.S.N.M., no. 1980, a ♂ from Los Angeles Co., Calif. (Coquillett). Provancher does not state exactly the type locality of his species, but does make the following statement: "M. D. W. Coquillett, d'Anaheim, Californie.... nous ayant fait un envoi d'hyménoptères de sa localité, nous y avons trouvé ce bel insecte...." On this basis I accept the Anaheim specimen as type. In any case, the two specimens are extremely similar, and there can be no doubt that they represent the same form.

In this far western subspecies of *algidus* the wings are for the greater part yellowish, with a narrow band of fuscous along the outer margins; another striking character is the color of the abdomen: the basal two segments are dark, castaneous or sometimes in part blackish, while the segments beyond the second are contrastingly paler, more or less yellowish.

FEMALE.—Length 18 (15–20) mm.; color rather variable, chiefly pale castaneous marked with yellow and fuscous. Antennae yellow-brown or reddish-brown, the apical 6 segments blackish. Head castaneous, the lower front and orbits suffused with yellowish; tips of mandibles black, upper margin of clypeus often marked with black, ocellar triangle marked with at least a little black, the front often with a large black median spot extending from the ocelli to the antennal bases in the middle of which is a pale spot in front of the anterior ocellus; vertex and occiput either pale or marked with black. Ground color of thorax and propodeum varying from almost wholly fuscous to almost wholly castaneous; yellow markings are always present on the lateral corners of the propodeal rim, the metanotum, and the posterior margin of the pronotum. Legs wholly castaneous, somewhat tinged with yellowish, or with the coxae, trochanters, and basal half of the femora blackish. First abdominal segment varying from castaneous to blackish; tergite 2 yellowish at base, at the posterior margin castaneous or infuscated; sternite 2 wholly castaneous or fuscous; remainder of tergites yellowish, with a darker band of castaneous or fusco-ferruginous along the posterior margin; remaining sternites varying from castaneous to yellowish. Wings bright flavo-hyaline, the setulae reflecting golden; outer margins of both pairs of wings with a narrow band of light fuscous. In other features this subspecies does not differ from *marcidus*; the propodeum has smooth contours as in that form.

MALE.—Length 15 (13–17) mm.; color in general not unlike that of the darker females. Antennae castaneo-ferruginous, the apical segments more or less infuscated, the tip of the last segment reddish. Head castaneous, more or less suffused with yellowish on the lower front and outer orbits; tips of mandibles black; sometimes a spot on the base of the mandibles and a streak along the upper margin of the clypeus black; front with a large median black area, extending from the antennal bases to the vertex, within which is a pale spot in front of the anterior ocellus; occiput black, this black either connected with that on the front and vertex or separated by a narrow band of pale. Thorax and propodeum mostly blackish; slope of pronotum more or less castaneous followed by a yellow band along the posterior margin; tegulae yellowish or pale castaneous; mesonotum marked with brownish posteriorly; scutellum with a spot of castaneous or yellowish; metanotum conspicuously marked with yellow; lateral corners of propodeal rim yellow; legs black at base, yellowish-brown beyond the basal two-thirds of the femora. Abdomen colored as in the female, always contrastingly paler beyond the basal two segments. Wings flavo-hyaline or pale yellowish-brown, the outer margins narrowly banded with pale fuscous. Other features as in typical *algidus*, except for the propodeum, which has much more even contours, the sides of the posterior slope being barely if at all protuberant.

Distribution.—This apparently uncommon form occurs in the Upper Sonoran fauna from southern California and the northern parts of Arizona and New Mexico to Salt Lake, Utah, and Butte Co., California.

Specimens seen: 15 (6 ♀♀, 9 ♂♂). NEW MEXICO: Sandoval Co., 2 ♂♂, Jemez Springs, July (J. Woodgate) [MCZ, CU]; ARIZONA: Coconino Co., 2 ♂♂, Oak Creek Canyon, 6000 feet, July (F. H. Snow) [UK]; UTAH: Juab Co., 1 ♀, Trout Creek, Ibapah Mts., 9 Aug. (T. Spalding) [AMNH]; Salt Lake City, 1 ♀ [MCZ]; CALIFORNIA: Butte Co, 1 ♀, Feather River, 15 Oct. [CU]; Los Angeles Co., 1 ♂ (Coquillett) [USNM]; Orange Co., 1 ♂, Anaheim (Coquillett) [QPM]; 3 ♀♀, 3 ♂♂, Newport Bay, May-Aug., 2 ♀♀ on *Eriogonum* (P. D. Hurd) [CIS].

2a. **Poecilopompilus interruptus interruptus** (Say)

(Plate XIV, fig. 44.)

Ceropales interrupta Say, 1835, Boston Jour. Nat. Hist., 1: 365. [Type. ♂; Indiana (no further data); (no longer extant).]—Smith, 1855, Cat. Hymen. Brit. Mus., III, p. 180.

Pompilus navus Cresson, 1867, Trans. Amer. Ent. Soc., 1: 105. [Type: ♀; Georgia (no further data); A.N.S.P. no. 426.]—Dalla Torre, 1897, Cat. Hymen., VIII, p. 304.

Pompilus interruptus Cresson, 1872, Trans. Amer. Ent. Soc., 4: 203. [Texas.] —Fox, 1894, Proc Calif. Acad. Sci., (2)4: 99. [Baja Calif.]—Dalla Torre, 1897, Cat. Hymen, VIII, p. 296.—Peckham and Peckham, 1898, Wisc. Geol. Nat. Hist. Survey Bull. no. 2, p. 152. [Biology.]—Birkmann, 1899, Ent. News, 10: 244. [Lee Co., Texas]

Pompilus ichneumoniformis Patton, 1879, Bull. U. S. Geol. Survey, 5: 351. [Type: ♀; Northwestern Kansas, 8 Sept. 1877 (S. W. Williston); (location of type, if still extant, not known to author).] [*Nec* Smith, 1864.]

Pompilus ichneumonoides Dalla Torre, 1897, Cat. Hymen, VIII, p. 295. [New name for *ichneumoniformis* Patton.]

Poecilopompilus navus Howard, 1901, The Insect Book, pl. XI, fig. 18.—Ashmead, 1902, Canad. Ent., 34: 82. [Selected genotype.]

Agenioxenus rufiventris Ashmead, 1902, Canad. Ent., 34: 137. [*Nec Ceropales rufiventris* Walsh; misidentification.]

Batazonus interruptus Banks, 1912, Ent. News, 23: 108. [At flowers of *Ceanothus* in Virginia.]—Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 130. [N. C.]—Brimley, 1938, Insects No. Carolina, p. 434.—Banks, 1944, Bull. Mus. Comp. Zool., 94: 167.—Dreisbach, 1949, Ent. Amer., (n.s.)29: 38, pl. III, fig. 12.

Batazonus navus Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 130.—Brimley, 1938, Insects No. Carolina, p. 434.

Batazonus ichneumonoides Banks, 1944, Bull. Mus. Comp. Zool., 94: 168. [Considered synonym of *navus* Cresson.]

There can be no doubt from the description, that Say had before him one of the darker males when he described this species; this has led Cresson and others to use Say's name for the melanic northeastern form which Banks has named *cressoni.* Nevertheless certain statements in the description make it clear that Say's type would have to be assigned to the subspecies which Cresson called *navus;* for example: "posterior band [of yellow on the propodeum] clavate each side on the pleura," and "coxae varied with yellow." *Interruptus interruptus* is so exceedingly variable a form in coloration as to almost defy description; it is probably the most brightly colored of our native Pompilidae, often suggesting certain species of *Polistes,* particularly *exclamans* Viereck, *bellicosus* Cresson, and *apachus* Saussure. Specimens from the Far West are often much paler than those from the East, but not constantly so.

FEMALE—Length 14 (11–18) mm ; color very variable, consisting of liberal yellow markings on a background of castaneo-ferruginous which is often suffused with a certain amount of black. Antennae castaneous at base, the apical 6 to 8 segments more or less infuscated. Mandibles castaneous or yellowish, the apices blackish, sometimes with a black spot at base. Clypeus castaneous, often a little yellow on the sides, rarely wholly yellow, sometimes the upper margin and rarely a central spot blackish. Lower front, inner orbits broadly, and outer orbits narrowly, yellow; upper front with a large median blotch extending from the antennal bases to the vertex, and connected at the vertex with the tops of the eyes by short laterally extending bands, and with the occiput by a short backward extending band; in color this blotch varies from castaneous to black, and is often a composite of both colors. Occiput and bases of maxillae and labium castaneous and/or blackish. Greater part of pronotum castaneous and/or black, marked with yellow as follows: the neck; a broad band along the posterior margin, extended along the sides to the anterior lateral margin or nearly so, then usually extended mesad along the anterior margin almost to the markings on the neck, but never connected with these. Tegulae yellow or castaneous. Mesonotum castaneous and/or black, almost always marked with yellow posteriorly, the yellow often extended forward as two diverging rami from the middle posterior margin. Scutellum castaneous and/or black, the sides and sometimes the entire posterior half yellow. Metanotum wholly yellow, or the extreme sides castaneous or black; postnotum castaneous or black. Propodeum castaneous and/or black, the posterior slope nearly always with a transverse yellow band or mostly yellow; posterior rim dark medially, otherwise yellow, the yellow commonly more or less extended onto the lower metapleura. Upper metapleuron also usually with a yellow spot, the sclerite otherwise castaneous and/or black, as is also the mesopleuron; the latter has a large subtriangular area at the lower posterior corner yellow, also rarely a spot just beneath the tegulae yellow. Coxae castaneous and/or black, always variegated with at least a small amount of yellow. Trochanters and greater part of femora castaneous and/or black; apex of femora and remainder of legs pale castaneous more or less suffused with yellowish, or mostly yellowish. Abdomen occasionally wholly castaneoferruginous, but usually with narrow to broad basal yellow bands on some or all of the tergites; posterior margin of some or all of the tergites sometimes narrowly to broadly infuscated. Front wings subhyaline to rather heavily infuscated, always suffused with yellowish at least along the costal margin, often over much of the wing; usually with a noticeable pale area in the vicinity of the 3d discoidal cell; outer margins with a pale fuscous band, often extended through the submarginal cells to the first discoidal cell; hind wings flavo-hyaline, the outer margin lightly infuscated.

Body clothed with a very fine pubescence, varying from pale brownish to silvery. Scape without erect hairs; short, pale erect hairs are present on the clypeus, front, vertex, temples, propleura, front coxae, pronotum, pleura, metanotum, propodeum, and first abdominal tergite.

Clypeus slightly over twice as broad as high, its apical margin slightly arcuately concave, its basal margin sinuate. Front broad, middle interocular distance about .62 × transfacial distance. Eyes converging above, though less strongly than in *algidus*; middle interocular distance subequal to lower interocular distance; upper interocular distance .65 to .72 × the lower. Vertex raised very slightly above the tops of the eyes, arcuate or nearly straight. Ocelli well below the vertex crest and about on a line drawn between the eyes at their point of greatest proximity; lateral ocelli connected with the eyes by a very faint depression; ocelli forming a flat triangle, post-ocellar line is to ocello-ocular line about as 4:3. Antennae long, the first 4 segments in a ratio of about 4:1:9:6, segment 3 subequal to or slightly greater than upper interocular distance.

Pronotum broadly angulate or subangulate behind. Postnotum short, concealed medially by the overhanging metanotum. Propodeum with very even contours, the median line not impressed; posterior rim prominent, its lateral corners obtusely angulate. Front tarsus with a comb of short spines, 4 of which are on the basitarsus, the apical one from half to three-fourths the length of the 2d tarsal segment. All the claws with a short erect tooth about half-way out. Fore wing with the marginal cell long and narrow, the radial vein evenly arched; 2d submarginal cell generally wider but not so high as the 3d.

MALE.—Length 11.5 (8–15) mm.; color not dissimilar to that of the female, but generally more liberally marked with yellow. Scape yellowish; flagellum reddish- or yellowish-brown, at most slightly infuscated apically. Palpi yellowish; mandibles yellowish, the tips and sometimes the base blackish. Clypeus yellow, usually with a median spot or band castaneous or black. Front and temples yellow; upper front with a large blotch of castaneous and/or black extending from the antennal bases to the vertex and connected to the tops of the eyes by a broad band, sometimes connected to the castaneous and/or black of the occiput by a band. Ground color of thorax varying from pale castaneous to black, often partly each, marked with yellow as in the female, except that the markings are frequently more ample. Coxae marked with a variable amount of yellow; trochanters and bases of femora castaneous or blackish; remainder of legs pale castaneous varied with yellow. Abdomen marked much as in the female, the alternate yellow and castaneous-and/or-black bands usually pronounced; sometimes, however, the abdomen is almost uniformly yellowish, dull ferruginous, or fuscous. Wings colored as in the female. Pubescence pale, reflecting silvery. Head and thorax with short, pale, erect hairs as in the female.

Head broader than high, transfacial distance about 1.25 × facial distance. Clypeus not as wide as the lower front, separated from the eye on each side by a space at least as great as the minimum malar space; clypeus about twice as broad as high, lower margin broadly truncate, upper margin strongly sinuate. Front broad, middle interocular distance about .61 × transfacial distance; eyes less broad than in *algidus*, each eye about 1.8 × as high as broad. Middle interocular distance about 1.1 × lower interocular distance; upper interocular distance from .95 to 1.0 × the lower, the eyes thus scarcely converging above. Ocelli in a flat triangle; post-ocellar line subequal to or slightly less than ocello-ocular line. Scape very short, hardly longer than thick; flagellum long and rather heavy; first 4 antennal segments in a ratio of about 10 : 3 : 18 : 17; segment 3 about 2.3 × as long as thick, alone equal to a little over half the upper interocular distance.

Pronotum very short, its posterior margin angulate. Propodeum short, with even contours; slope slightly more steep behind; posterior rim prominent, its lateral angles obtuse. Legs long, spinose; longer spur of hind tibia about three-fourths the length of the basitarsus. Venation as in female.

Abdomen less markedly flattened dorsally than in *algidus*. Sternite 6 with a shallow U-shaped emargination; subgenital plate more tapering behind than in *algidus*, the apex narrowly rounded. Genitalia (fig. 44) with the aedoeagus slender, the apex narrowly bilobed, the shaft with a few minute setulae; parapenials simple, slender; basal hooklets double, the upper hook prolonged upward; basis volsellaris with a few long setae; digiti elongate-spatulate, with scattered small setae toward the outer sides; parameres slender, slightly curved, with a group of long setae near the base on the inner margin.

Biology.—This species was studied by the Peckhams (1898), who found it preying upon *Epeira strix* (i.e., *Epeira foliata* Fourcroy), and nesting in a short gallery in the earth, only a little over an inch in length. A specimen from Baldwin, Kansas [USNM] is pinned with an *Argiope aurantia* Lucas [det. B. J. Kaston]. The species appears to have but one generation a year in the North, being on the wing from July to early September; farther south it occurs throughout the warmer months of the year and undoubtedly has at least two generations. It has been collected on a wide variety of flowers, among which are *Daucus carota, Pastinaca sativa, Cicuta maculata, Polytaenia nuttallii, Ampelopsis arborea, Avicennia nitida, Tamarix gallica, Cleome serrulata, Polygonum* sp., *Solidago* spp., *Baccharis glutinosus, Helianthus annuus, Asclepias* spp., and *Melilotus alba.*

Distribution.—This form occurs throughout the Lower Austral Zone transcontinentally, and through much of the Upper Austral except in the Far West, occurring from the southern limits of the United States north to central California, Utah, South Dakota, Michigan, southern Ontario, and southern New Jersey. In the northeastern states it is replaced by subspecies *cressoni* Banks.

Specimens seen: 352 (172 ♀♀, 180 ♂♂). There are many records from Florida, the Gulf States, and the states bordering Mexico; the species undoubtedly occurs in parts of Mexico, though I have seen no Mexican specimens. The following records define the northern periphery of its range as far as present data indicate· NEW JERSEY: Cape May Co., 3 ♀♀, 8 July [ANSP]; DELAWARE: 1 ♂ [ANSP]; VIRGINIA: Fairfax Co., 1 ♀, Dunn Loring, 26 July [KVK]; OHIO: Delaware Co., 1 ♀, 2 Aug. [RWS]; ONTARIO: 1 ♀, Pt. Pelee, 8 July [CNC]; MICHIGAN: Kalkaska Co., 1 ♂, Aug. [MCZ]; WISCONSIN: 1 ♂, Milwaukee, 18 Aug. [MCZ]; ILLINOIS: 3 ♀♀, 2 ♂♂, Chicago, July [MCZ]; IOWA: Woodbury Co., 3 ♀♀, 1 ♂, Sioux City, July-Sept. [USNM]; SOUTH DAKOTA: Brule Co., 1 ♀, Chamberlain, 22 July [SDS]; WYOMING· Weston Co, 1 ♂, Clifton, 15 Aug. [Minn.]; UTAH: Utah Co., 1 ♀, 1 ♂, Utah Lake, 16 Aug. [HEE]; CALIFORNIA: Yolo Co., 1 ♂, Davis, July [CIS].

2b. **Poecilopompilus interruptus cressoni** (Banks)

Pompilus interruptus Cresson, 1867, Trans. Amer. Ent. Soc., 1: 104. [*Nec* Say, 1835; misidentification.] [Mass., Conn., Pa., Del.]—Cresson, 1887, Synopsis Hymen., Suppl. Vol., Trans. Amer. Ent. Soc., p. 271.

Poecilopompilus interruptus Howard, 1901, The Insect Book, pl. V, fig. 1.

Anoplius interruptus Smith, 1910, Ann. Rpt. N. J. State Mus. 1909, p. 674.

Arachnophroctonus interruptus Rohwer, Conn. Geol. Nat. Hist. Survey Bull. 22, p. 632.—Britton, 1920, Conn. Geol. Nat. Hist. Survey Bull. 31, p. 336.

Batazonus interruptus Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 985. [N. Y., many localities.]

Batazonus interruptus var. *cressoni* Banks, 1944, Bull. Mus. Comp. Zool., 94: 167. [Type: ♀; Holliston, Mass., July (Banks); M.C.Z. no. 25,729.]

This form differs from typical *interruptus* only in the consistently darker coloration; it inhabits the northeastern United States, north and east of the range of the typical subspecies.

Female.—Length 13.5 (10.5–16.5) mm.; color black, with limited markings of yellow and ferruginous. Basal 3 or 4 segments of antennae castaneous, the remaining segments blackish above, castaneous below. Mandibles black at base and apex, in the middle ferrugino-castaneous. Clypeus ferrugino-castaneous, a large black blotch in the center connected with the black upper margin. Front, vertex, and occiput black; inner and outer orbits bordered with yellowish and/or castaneous. Thorax and propodeum black; tegulae castaneous; the following are yellow: posterior margin of pronotum, usually a spot on each side of the scutellum, a spot at the center of the metanotum, the lateral corners of the propodeal rim, and sometimes a spot on the lower mesopleura. Coxae black, except that the apex of the front pair may be brownish; trochanters black; basal one-third to four-fifths of the femora black; remainder of legs pale castaneous, the apices of the tarsal segments darker; hind tibiae usually somewhat infuscated apically. Abdomen for the greater part blackish or dusty-ferruginous, the apices of most of the segments and sometimes all of the last three segments paler, dusky ferrugino-castaneous; occasionally there is a poorly developed yellowish band or pair of spots on the 2d and/or 3d tergite. Fore wings flavo-hyaline or light yellowish-brown, with a fuscous band along the margin, the fuscous extending across the submarginal cells and first discoidal cell to the basal vein; hind wings flavo-hyaline, the outer margin broadly, lightly infuscated. Pubescence of body light brownish to silvery; erect hairs pale, distributed as in the nominate subspecies.

Male.—Length 11.5 (8–15) mm.; color much like that of the female. Scape yellowish below; flagellum wholly ferruginous or somewhat castaneous, the upper half of the segments sometimes infuscated. Mandibles black at base, yellowish in the middle, reddish at apex. Clypeus usually in greater part black, bordered with yellow below and on the sides. Front, vertex, and occiput black; inner and outer orbits yellowish and/or castaneous, the pale coloration of the inner orbits wider below, sometimes meeting beneath the antennal bases. Thorax and propodeum black; tegulae and wing-bases castaneous; yellow are: the neck, the posterior pronotal margin, often a spot on each side of the scutellum, a conspicuous spot on the metanotum medially, the lateral corners of the propodeal rim, a spot of variable size and shape on the lower mesopleuron, rarely a spot on the upper metapleuron, rarely spots or a feeble band on the slope of the propodeum. Coxae black, the apex of the front coxae castaneous or yellowish, the hind coxae rarely marked with a little yellow above; trochanters and greater part of the femora black; apices of femora, and the tibiae, pale castaneous, except the apex of the hind tibiae somewhat infuscated, and the bases of the middle and hind tibiae on the outside yellowish; spurs yellowish; tarsi yellowish, the apices of the segments, and the entire apical segment, darker. Abdomen varying from wholly blackish to wholly dusky castaneo-ferruginous, occasionally obscurely banded, often with a narrow band or paired spots of yellow on tergite 2 and/or tergite 3. Wings subhyaline, suffused with yellowish at least along the costal margin of the fore wing, the outer margins with a band of pale fuscous which is extended across the submarginal cells and first discoidal cell of the fore wing as in the female.

Biology.—A female from Boston, Mass. [CAS] is pinned with the spider *Epeira trifolium* Hentz, ♀ [det. B. J. Kaston]. This form is often taken in sandy places, or in open areas on the blossoms of flowers; it has been taken on *Pastinaca sativa, Solidago,* and *Spiraea.* Males appear in the field in mid-June, the females a week or two later; the latest records are for mid-September. I presume there is but one generation a year.

Distribution.—This form inhabits the Carolinian fauna and portions of the Alleghanian fauna of the northeastern United States, from eastern Ohio and northern Virginia to Massachusetts; a single female from East Sister Island, Ontario, Canada, also appears to belong here.

Specimens seen: 86 (35 ♀♀, 51 ♂♂). The following records are marginal: MASSACHUSETTS: Suffolk Co., 2 ♀♀, Boston, Aug. [CAS]; Hampshire Co., 1 ♀, 1 ♂, Cummington, 26–31 Aug. [HEE]; NEW YORK: Putnam Co., 5 ♀♀, Putnam Valley, 5–12 Sept. [CU, HEE]; Tompkins Co., 3 ♀♀, 5 ♂♂, Ithaca, July [HEE, CU, USNM]; Monroe Co, 1 ♂, Rochester Jct., 7 July [CU]; ONTARIO: 1 ♀, E. Sister Isl., July [MCZ]; OHIO: Lawrence Co., 1 ♂, 6 Sept. [RWS]; PENNSYLVANIA: Huntingdon Co., 1 ♂, Charter Oak, 11 July [MCZ]; DISTRICT OF COLUMBIA: 2 ♂♂, Washington, July-Aug. [USNM, Minn.]; VIRGINIA: Fairfax Co., 1 ♀, 1 ♂, Falls Church, June–July (Banks) [MCZ]; DELAWARE: 1 ♀ [ANSP]; NEW JERSEY: Cape May Co., 2 ♂♂, Cape May, 5 Aug. [ANSP].

VIII. Genus **TACHYPOMPILUS** Ashmead

Tachypompilus Ashmead, 1902, Canad. Ent., 34: 83. [Type: *Tachypompilus abbotti* Ashmead, 1902 (=*analis* Fabricius, 1781); monobasic.]—Haupt, 1930, Mitt. Zool. Mus. Berlin, 15: 606.—Banks, 1934, Proc. Amer. Acad. Arts and Sci., 69: 84, 86. [Philippine species.]

Arachnophroctonus Ashmead, 1902, Canad. Ent., 34: 83. [Type: *Ceropales ferruginea* Say, 1824; monobasic.] [*Nec* Howard, 1901.] New synonymy.—Banks, 1911, Jour. N. Y. Ent. Soc., 19: 224.—Dreisbach, 1949, Ent. Amer., (n.s.)29: 6, 8 (but not pl. IV, fig. 17).

Arachnophoctonus Rau and Rau, 1918, Wasp Studies Afield, p. 78. [Typographical error for *Arachnophroctonus* Ashmead.]

Balanoderes Haupt, 1929, Mitt. Zool. Mus. Berlin, 15: 119, 155. [Type: *Sphex analis* Fabricius, 1781; designated by Haupt, 1929.] [Placed in synonymy with *Tachypompilus* by Haupt, 1930.]

Afropompilus Arnold, 1936, Ann. Transvaal Mus., 18: 107. [Type: *Pompilus ignitus* Smith, 1855; original designation.] New synonymy.

Arachnoproctonus Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 129. [Typographical error for *Arachnophroctonus* Ashmead.]

Zarachnophroctonus Pate, 1946, Trans. Amer. Ent. Soc., 72: 130. [New name for *Arachnophroctonus* Ashmead, 1902, *nec* Howard, 1901.] New synonymy.

This distinctive and showy genus has been given tribal rank by Arnold.[46] I consider it closely related to *Anoplius* and *Pompilus,* and unworthy of such rank. In many parts of the world species of *Tachypompilus* form a conspicuous element among the Pompilini. The genus is not, however, a large one, nor do any of the species seem to be abundant. Unfortunately the North American forms have always been incorrectly placed in the genus *Arachnophroctonus.*

In the American fauna, the species of *Tachypompilus* are apt to be confused only with those of *Poecilopompilus,* which are also brightly colored. There are, however, many structural differences between the genera, and I do not consider them closely related, as does Banks.[47] The postnotum of *Tachypompilus* is very short, and not expanded on the sides; the front tibiae are not spinose above. The blunt tubercle just above the bases of the antennae (figs. 54 and 55) forms the best single character for identifying the genus. The American species are predominantly castaneous or ferruginous, with variable amounts of black.

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[46] Arnold, George, 1937, Ann. Transvaal Mus., 19: 76.

[47] Banks, Nathan, 1947, Bull. Mus. Comp. Zool., 99: 381.

Generic characters.—Species of moderate or rather large size, 7 to 30 mm. in length. Color in small or large part castaneo-ferruginous, the only other color which may be present being black. Body smooth, the pubescence very fine, erect hair sparse to moderately abundant; pygidium of female setose, but none of the setae bristly.

Mandibles with a single strong tooth on the inner margin, some females with a weak second tooth basad of this. Clypeal disc convex, the apical margin truncate or emarginate. Labrum usually protruding slightly from beneath the clypeus, its apex deeply cleft. Malar space short or of moderate length. Front distinctly tuberculate just above the bases of the antennae on the median line (figs. 54 and 55), the convexity occasionally with a carina which extends downward to the clypeus. Front of the male, when not distinctly tuberculate, at least with a convexity which slopes abruptly to the face below the antennal orbits. Antennae elongate, segment 3 in the female always much longer than 4. Front of moderate breadth, the eyes converging at most moderately above.

Pronotum short, the posterior margin arcuate or subarcuate, the median line slightly impressed. Postnotum a narrow, nearly linear transverse band, which may be somewhat concealed on the median line by the overhanging metanotum Propodeum rarely with even contours, but with the declivity usually well-defined, flat or more often concave, and the sides of the declivity humped or ridged, sometimes with one or more pairs of tubercles; there are also tubercles in front of the spiracles in some species. Legs long and slender, particularly the front coxae and femora of the female. Front tibiae with a few spines on the sides, none above. Front tarsus of female with a strong comb, the spines of which are considerably longer than the width of the tarsus. Apical tarsal segments with several median spines beneath, at least in the female. Pulvillar comb weak, of at most 12 slender, somewhat diverging setulae. Claws of the female dentate, those of the male bifid or subbifid. Last segment of front tarsus of male modified slightly, the segment a bit asymmetrical, the inner claws more abruptly curved than the outer, and with the rays more widely separated.

Wings large, never folded in repose. Anal vein of hind wing meeting the media near or at the fork of the cubital vein. Basal and transverse median veins of fore wing interstitial or nearly so on the media. Stigma large, pigmented; marginal cell large, always notably less than its own length from the wing-tip. 2d and 3d submarginal cells both rather large, 4-sided. 3d discoidal cell much less than its own length from the wing margin.

Abdomen of both sexes relatively stout, the first 3 segments large, the first tergite strongly convex in front. Male subgenital plate strongly keeled; basally, within the body, with a wing-like expansion on each side. Male genitalia (figs. 67 and 68) with the parameres long, slender, with a membranous area of variable breadth on the inner margin near the apex. Basal hooklets single or feebly doubled. Volsella with several strong hairs at the base; about midway on the digitus there is a transverse fold, beyond which the digitus is rather densely setose. Parapenial lobes supporting the aedoeagus closely; aedoeagus always bearing a number of setae along the shaft. The genitalia of the genotype, *analis* (fig. 68), resemble very closely those of the American *ferrugineus* (fig. 67). In fact, the genitalia are fairly uniform throughout the genus, most of the specific characters being in the aedoeagus.

Biology.—The species of *Tachypompilus* prey upon large lycosid or pisaurid spiders which, like most Pompilinae, they drag backward over the ground. Their nesting habits seem to be variable. The North American *ferrugineus* nests in walls and crevices, often in buildings. The habits of the genotype, *analis* Fabricius, are somewhat different; this species has been studied by Williams.[48] *Analis* nests in shallow pits in the ground, a number of such pits being made and stocked in the same small area, usually at the base of a tree. The abdomen is used to pound down the soil over the nest, and debris is placed over the spot to conceal it.

Distribution.—Widespread in the tropical and subtropical parts of the globe. *T. analis* Fabricius is widely distributed in the Orient, and *T. praepotens* Kohl in Africa. A considerable number of species have been described from the American tropics, but further study may reduce these to a few polytypic species. In our fauna there are two species, each with several subspecies.

Key to Species

Females and Males

1. Female: Antennal segment 3 from 1.3 to 1.8 × upper interocular distance; eyes rather strongly convergent above, upper interocular distance about .8 (.72–.86) × lower interocular distance; vertex not raised above the eye-tops; temples not at all developed. Male: Eyes not diverging above, upper interocular distance from .9 to 1.0 × the lower; antennal segment 3 more than twice as long as its greatest thickness; aedoeagus beset with rather long spines along the shaft (*ferrugineus*) 2

Female: Antennal segment 3 shorter, from .9 to 1.2 × upper interocular distance; eyes more widely separated at the top, upper interocular distance .9 (.85–1) × the lower; vertex very slightly arcuately raised above the level of the tops of the eyes. Male: Eyes slightly diverging above, upper interocular distance from 1.05 to 1.15 × the lower; antennal segment 3 not more than twice as long as its greatest thickness; spines of aedoeagus somewhat shorter (*torridus*) 5

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[48] Williams, F. X., 1919, Bull. Hawaiian Sugar Planters' Assoc., Ent. Ser., no. 14, pp. 108–110.

2. Thorax extensively marked with black; meso- and metapleura and propodeum mostly blackish; basal abdominal tergites strongly banded with black at their apices; wings more or less fuscous, violaceous 3

Body almost entirely ferruginous; thoracic pleura and propodeum at most in small part blackish; abdominal tergites banded with black or not; wings variable 4

3. Head and thorax almost entirely black; mesonotum black, usually also the pronotum and coxae; femora often partly black; antennae mostly black, at least in the female, the basal 1 to 3 segments ferruginous
1b. **ferrugineus nigrescens** (Banks)

Head and thorax in large part ferruginous; pro- and mesonota mostly or wholly ferruginous, femora entirely so; antennae of females gradually infuscated distad, the apical few segments blackish
1a. **ferrugineus ferrugineus** (Say)

4. First abdominal tergite with a narrow dark band along its posterior margin, the following tergites usually with less well-defined bands. Female: Apex of mesosternum, in front of the middle coxae, not produced into lobes. Male: Wings rather heavily infuscated
1c. **ferrugineus burrus** (Cresson)

Abdominal tergites much less distinctly banded apically, the abdomen nearly uniformly ferruginous. Female· Apex of mesosternum, in front of the middle coxae, produced into small, acute lobes. Male: Wings subhyaline or very lightly infuscated, the apices darker
1d **ferrugineus yavapai** new name

5. Wings flavo-hyaline or nearly clear hyaline, the apices of both pairs of wings distinctly narrowly infuscated; body color usually nearly uniformly ferrugino-testaceous ....2. **torridus torridus** (Smith)

Wings brownish in varying degrees, usually somewhat violaceous, the apices darker, but less contrastingly so; body wholly ferruginous or more or less marked with black, especially in the males
2b. **torridus unicolor** (Banks)

1a. **Tachypompilus ferrugineus ferrugineus** (Say) new combination
(Plate XV, figs. 54, 55, 57; plate XVI, figs. 67, 71.)

Ceropales ferruginea Say, 1824, Narr. Exp. St. Peter's River, II, p. 334. [Type: ♂; "United States"; (no longer extant).]

Pompilus ferrugineus Dahlbom, 1844, Hymen. Europ., I, p. 63.—Smith, 1855, Cat. Hymen. Brit. Mus., III, p. 159.—Cresson, 1867, Trans. Amer. Ent. Soc., 1: 107. [Del., Ill., La.]—Cresson, 1872, Trans. Amer. Ent. Soc., 4: 203. [Texas.]—Dalla Torre, 1897, Cat. Hymen., VIII, p. 288.—Birkmann, 1899, Ent. News, 10: 244. [Lee Co., Texas.]—Howard, 1901, The Insect Book, pl. VI, fig. 11.

Priocnemis nuperus Howard, 1901, The Insect Book, pl. VI, fig. 3. [Misidentification.]

Arachnophroctonus ferrugineus Ashmead, 1902, Canad. Ent., 34: 83. [Selected genotype of *Arachnophroctonus* Ashmead, 1902, *nec* Howard, 1901.]—Rau and Rau, 1918, Wasp Studies Afield, pp. 78–83. [Biology.] —Brimley, 1936, Jour. Elisha Mitchell Sci. Soc., 52: 129. [N. C., many localities.]—Brimley, 1938, Insects No. Carolina, p. 434.—Banks, 1944, Bull. Mus. Comp. Zool., 94: 168. [Selects neotype from Falls Church, Va.]—[not] Dreisbach, 1949, Ent. Amer., (n.s.)29: 40, pl. IV, fig. 17. [Misidentification.]

Anoplius (Arachnophroctonus) ferrugineus Viereck, 1906, Trans. Amer. Ent. Soc., 32: 223. [Galveston, Texas.]

This well-known form, which occurs over much of the United States east of the Rockies, is at once recognized by its black meso- and metapleura and propodeum against a general castaneo-ferruginous body color; the apices of the abdominal tergites are also banded with black.

Female.—Length 18 (15–22) mm. Body bright castaneo-ferruginous, except as follows: tips of mandibles black; antennae infuscated beyond the basal few segments; front coxae usually in small part black, the other coxae with a larger amount of black, sometimes wholly black; anterior part of mesonotum with or without a black transverse band; sides of the metanotum infuscated; mesopleura, mesosternum, metapleura, postnotum, and propodeum wholly or in large part blackish; tergites 1 and 2 with conspicuous dark bands along their posterior margins, the remaining tergites at most slightly infuscated apically. Body clothed with a very fine pale brown pubescence, more noticeable on the front and coxae. Wings brownish-fuliginous, rather strongly reflecting violet. Body with a few short, pale hairs on the front, vertex, temples, prosternum, front coxae, sides of the propodeum, and to a lesser extent elsewhere on the thorax.

Mandibles strongly unidentate (fig. 71). Clypeus about twice as broad as high, its apical margin broadly emarginate. Front of moderate breadth, middle interocular distance from .55 to .6 × transfacial distance; middle interocular distance very slightly greater than lower interocular distance; upper interocular distance from .75 to .86 × the lower, the eyes thus noticeably convergent at the top. Ocelli prominent, post-ocellar line subequal to or slightly greater than ocello-ocular line. Supra-antennal tubercle well developed. Temples not strongly developed, in lateral view not nearly as broad as the eyes. Antennae elongate, the first 4 segments in a ratio of about 3:1:6:4.5, or the 3d segment proportionally even longer; 3d segment equal to from 1.3 to 1.8 × upper interocular distance. (Figs. 54 and 57.)

Pronotum short, the posterior margin arcuate. Propodeum rather long, somewhat humped antero-dorsally and postero-laterally, the declivity well-defined, flat or a little concave; median line impressed above; there is a slight hump in front of each spiracle. Spines of the tarsal comb about 3 ×

as long as the width of the very slender tarsus; there may be 4 or 5 comb-spines on the basitarsus, rarely 3 or 6. Tibial spurs short in relation to the length of the legs; longer spur of hind tibia .4 the length of the basitarsus. Fore wing with the marginal cell from half to two-thirds its own length from the wing-tip; 2d recurrent vein somewhat bent in the middle.

MALE.—Length 13 (8–17) mm. Coloration very similar to that of the female; antennal flagellum usually almost wholly infuscated; mesonotum usually with some black anteriorly; scutellum sometimes black on the sides. Wing color and pubescence as in the female. This sex is inclined to have slightly more erect, pale hair on the front and prothorax.

Clypeus about twice as broad as high, its apical margin truncate or very slightly concave. Front of moderate breadth, middle interocular distance from .59 to .66 × transfacial distance. Upper interocular distance from .9 to 1.0 × the lower, the eyes thus subparallel within. Ocelli large, post-ocellar line is to ocello-ocular line about as 4:3. Front very convex above, protuberant just above the antennal bases, below which point it slopes steeply to the face below. Temples not developed, the head contracted immediately behind the eyes. Antennae slender, the first 4 segments in a ratio of about 2.5:1:2.7:2.7, though somewhat variable in this respect; segment 3 from 2 to 3 × as long as its greatest thickness (fig. 55).

Postero-lateral angles of the propodeum distinctly protuberant, the declivity concave between; median line of propodeum clearly impressed above. Front coxae and femora much shorter than in the female. Apical tarsal segments weakly if at all spined beneath.

Abdomen in resting position short and stout, the apical segments often somewhat telescoped into the first two, which are very large. Sternite 6 with a large U-shaped emargination. Subgenital plate strongly keeled, in profile sloping convexly behind. Genitalia (Fig. 67) with the parameres slender, expanded apically, the expansions on the inner margin and mostly membranous. Aedoeagus spindle-shaped, apically very acute, bearing along its shaft numerous spine-like setae of varying lengths, some of which are fairly long and extend beyond the margin of the aedoeagus when pressed against it.

Biology.—This form is frequently taken around rock-piles, stone walls, and buildings, where it nests in crevices. When in buildings, the emerging adults sometimes find their way to the interior of the building rather than the exterior, so that they are sometimes taken on windows. The Raus (1918) are to be credited with the only detailed observations on the habits of this species. They found it nesting in the stone wall of the foundation of an abandoned building. The prey, a *Lycosa,* is dragged backward, even up the perpendicular sides of the wall. The Raus suggest that it may once have nested in the loose stone of cliffs, but now makes use of man-made structures when these are available. The species also preys upon *Dolomedes* sp. (Pisauridae) [det. B. J. Kaston], as shown by a specimen taken at Elfers, Florida [KVK] pinned with this spider.[49] Flower records for this species include *Daucus carota, Aralia spinosa, Monarda punctata, Ampelopsis arborea,* and *Euphorbia marginata.*

Distribution.—This form inhabits the Lower and Upper Austral Zones east of the Rockies, from central eastern Texas and southern Florida to Colorado, Minnesota, Ohio, and New Jersey. In the northeastern states it is replaced by subspecies *nigrescens,* and in the Southwest by subspecies *burrus* and *yavapai.*

Specimens seen: 263 (150 ♀♀, 113 ♂♂). The following localities define the northern and western limits of its range so far as present records go: NEW JERSEY: Burlington Co., 1 ♀, Moorestown, 6 Aug. [USNM]; Cape May Co., 7 ♀♀, 10 ♂♂, 15 July-28 Aug. [ANSP]; PENNSYLVANIA: Lancaster Co., 1 ♀ [HEE]; MARYLAND: St. Marys Co., 1 ♂, Blakiston Isl., 7 Aug. [USNM]; WEST VIRGINIA: Randolph Co., 1 ♀, 1 ♂, Cheat Mt. [CM]; OHIO: Erie Co., 1 ♀, Sandusky, 21 July [ANSP]; INDIANA: Clinton Co., 1 ♂, Edna Mills, 11 July [Minn.]; ILLINOIS: 1 ♀ (no further data) [ANSP]; MINNESOTA: Hennepin Co., 1 ♂, Minneapolis, 27 June [Minn.]; KANSAS: Riley Co., 8 ♀♀, 4 ♂♂, Aug.-Sept. [KSC]; COLORADO: Boulder Co., 7 ♀♀, Boulder Canyon, 17 Aug. [Minn.]; TEXAS: Tarrant Co., 1 ♀, Arlington [USNM]; Lee Co., 2 ♀♀, 1 ♂, Fedor, May-Sept. [MCZ, CIS]; Galveston Co., 3 ♀♀, 5 ♂♂, June [MCZ, USNM]. There are abundant records from the southeastern states, especially Florida.

1b. **Tachypompilus ferrugineus nigrescens** (Banks) new combination

Pompilus ferrugineus Smith, 1890, Cat. Insects N. J., p. 50.

Anoplius ferrugineus Smith, 1910, Ann. Rpt. N. J. State Mus. 1909, p. 674.

Arachnophroctonus ferrugineus Leonard, 1926, Cornell Agri. Exp. Sta. Memoir 101, p. 985.—Britton, 1938, Conn. Geol. Nat. Hist. Survey Bull. 60, p. 146.

Arachnophroctonus ferrugineus var. *nigrescens* Banks, 1944, Bull. Mus. Comp. Zool., 94: 169. [Type: ♀; Arlington, Va., 17 Aug. (Banks); M.C.Z. no. 25,732]

This form occurs in the northeastern United States, north and east of the range of the nominate subspecies, although there is some overlapping in range, and intermediates are not uncommon. The case parallels that of *Poecilopompilus interruptus,* which also has a melanic form in the Northeast, *cressoni*. The right of these forms to be considered subspecies is questionable; the darker coloration may be caused by the direct effect of lower temperature or other physical factors rather than genetic make-up.

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[49] A later paper by Rau (1922, Trans. Acad. Sci. St. Louis, v. 24, no. 7, p. 12), not seen by the author when the above was written, reports this wasp as preying upon *Dolomedes idoneus* Emerton (=*D. tenebrosus* Hentz).

FEMALE.—Length 16.5 (14–19) mm., averaging slightly smaller than the typical form. Color bright ferruginous, except black as follows: antennal flagellum except sometimes the first 1 or 2 segments; tips of mandibles; front, vertex, temples, and occiput variably infuscated, usually mostly blackish; entire thorax and propodeum black except usually a spot on the metanotum and scutellum, and sometimes a small part of the pro- and mesonota; coxae, trochanters, and usually the bases of the femora blackish; base and apex of tergite 1 black, also apical bands on tergites 2 and 3, and the greater part of sternites 1-3. Wings fuliginous, violaceous. Pubescence very fine, brownish varying to silvery on the front, coxae, and lower pleura. Other features as in the typical subspecies.

MALE.—Length 13 (11–17) mm. Coloration much as in the female; flagellum often wholly black, sometimes merely dusky-ferruginous; clypeus, inner orbits below, and outer orbits pale; front, vertex, and occiput usually dusky or black; posterior margin of pronotum narrowly pale; femora varying from wholly black to wholly pale.

Biology.—This form appears in the field in early July and disappears in late August, having but one generation a year. It has been taken in gravel banks and around rock piles, and also on the flowers of *Daucus carota, Solidago,* and *Spiraea.*

Distribution.—This form inhabits the Carolinian and Alleghanian faunas of the states of New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, and New Jersey. The type is from Arlington, Virginia, somewhat south of the normal range of the subspecies. There is a considerable band of overlap of this and the typical subspecies from Pennsylvania and New Jersey to northern Virginia.

Specimens seen: 60 (31 ♀♀, 29 ♂♂). The following records are marginal: NEW HAMPSHIRE: 2 ♂♂ (no further data) [USNM]; Hillsboro Co., 1 ♂, Pelham, 17 Aug. [USNM]; MASSACHUSETTS: Middlesex Co., 1 ,♂, Holliston, Aug. [MCZ]; CONNECTICUT: Litchfield Co., 1 ♂, Colebrook [MCZ]; NEW YORK: Dutchess Co., 1 ♀, Poughkeepsie, 26 July [KVK]; Tompkins Co., 8 ♀♀, 12 ♂♂, Ithaca, 23 June–3 Aug. [HEE]; Erie Co., 1 ♀, Hamburg, 24 July [CIS]; PENNSYLVANIA: Cumberland Co., 1 ♂, West Fairview, 31 July [USNM]; NEW JERSEY: Cape May Co., 1 ♀, 2 ♂♂, Cape May, 21 July–24 Aug. [ANSP]; VIRGINIA: 1 ♀, Arlington, 17 Aug. [MCZ].

1c. Tachypompilus ferrugineus burrus (Cresson) new combination

Pompilus torridus var. *burrus* Cresson, 1869, Proc. Boston Soc. Nat. Hist., 12: 371. [Lectotype: ♀; Vera Cruz, Mexico (Charles Sartorius); A.N.S.P. no. 429.]

Arachnophroctonus torridus var. *burrus* Bradley, 1944, Notulae Naturae, Acad. Nat. Sci. Phila., no. 145, p. 9.

Arachnophroctonus ferrugineus var. *annexus* Banks, 1944, Bull. Mus. Comp. Zool., 94: 168. [Type: ♀; Fedor, Lee Co., Texas, 15 June 1909 (Birkmann); M.C.Z. no. 25,731.] New synonymy.

This form is very similar to typical *ferrugineus,* but without much if any black on the propodeum and the thoracic pleura. It is distinguishable from the following subspecies by the usually more distinct dark bands on the basal abdominal tergites, and by the absence of small projections on the mesosternum in front of the middle coxae. *Torridus torridus,* the range of which overlaps that of this form, may be told by the much paler wings and broader vertex than *ferrugineus burrus.*

FEMALE.—Length 20 (15–27) mm., averaging slightly larger than typical *ferrugineus.* Body bright castaneo-ferruginous, overlaid by a very fine silvery or light brown pubescence. Antennae infuscated apically, the last few segments black; tarsi somewhat infuscated apically; extreme base of tergite 1 black, and the posterior margin of this tergite with a narrow dusky or black border, tergites 2 and 3 usually with less well-defined dark bands. Occasionally there is a small amount of black on the thorax and on the propodeal declivity. Wings fuliginous, violaceous. Tarsal comb strong, most commonly with 5 comb-spines on the basitarsus.

MALE.—Length 15 (10–19) mm.; color in general like that of the female. Antennal flagellum usually blackish above, more or less ferruginous below for most of its length; mesosternum and hind coxae in front often marked with blackish. Wings wholly and rather heavily infuscated, more or less violaceous. Morphologically very similar to typical *ferrugineus.*

Biology.—I have taken this form in series in a screened porch in Dallas, Texas, and on a stone wall in Austin. It is a frequent visitor to flowers, and has been taken on *Cicuta maculata, Avicennia nitida, Ampelopsis arborea,* and *Euphorbia marginata.*

Distribution.—Eastern Mexico north through eastern Texas, with an occasional specimen from as far north as Kansas. There is a considerable area of overlap with the typical subspecies.

Specimens seen: 123 (79 ♀♀, 44 ♂♂). KANSAS: Riley Co., 2 ♀♀, Manhattan, Aug. [KSC, coll. R. L. Fischer]; TEXAS: Bexar Co., 12 ♀♀, 4 ♂♂, June-July [JEG]; Brazos Co., 12 ♀♀, 6 ♂♂, June-Aug. [RWS, JEG]; Caldwell Co., 1 ♀, Maxwell, June [RWS]; Cameron Co., 1 ♀, Brownsville, 14 July [HEE]; 20 ♀♀, 21 ♂♂, Port Isabel, 22 June [HEE, CU]; Comal Co., 1 ♀, New Braunfels, 29 June [HEE]; Dallas Co., 10 ♀♀, Dallas, June-Oct. [HEE, MCZ, USNM]; Dewitt Co., 1 ♀, Cuero, Aug. [CAS]; Galveston Co., 1 ♀, Dickinson, 26 May [KVK]; Hunt Co., 2 ♂♂, June, July [RWS]; Lee Co., 4 ♀♀, Fedor, June-Sept. [MCZ]; Nueces Co., 5 ♂♂, Robstown, 21 Apr. [JEG]; San Jacinto Co., 1 ♀, Aug. [RWS]; Titus Co., 1 ♀, Mt. Pleasant, 13 June [HEE]; Travis Co., 4 ♀♀, Austin, Apr.-July [HEE, MCZ]; Uvalde Co., 1 ♀, Uvalde, 15 June [CAS]; Victoria Co., 1 ♀, Black Bayou [CM]; 5 ♀♀, 1 ♂, Victoria [USNM]; Walker Co., 1 ♂, Huntsville [USNM]; Williamson Co., 3 ♂♂, May-June [JEG]; 1 ♀, Taylor, 20 Aug. [KVK]; MEXICO: 1 ♀, Vera Cruz [ANSP].

1d. **Tachypompilus ferrugineus yavapai** new name

Arachnophroctonus ferrugineus var. *unicolor* Banks, 1944, Bull. Mus. Comp. Zool., 94: 168. [Type: ♀; Oak Creek Canyon, Arizona, 6000 feet (F. H. Snow); M.C.Z. no. 25,730.] [*Nec* Banks, 1919.]

In this subspecies the body is without any black markings whatever; the wings of the female are moderately infuscated, violaceous, those of the male very lightly infuscated. This form has usually been confused with what has been called *unicolor,* but is clearly a subspecies of *ferrugineus,* as evidenced by the narrow vertex, longer third antennal segment, larger size, and strongly spined aedoeagus of the male.

FEMALE.—Length 18 (14–22) mm.; color light castaneo-ferruginous, overlaid with a fine pale brownish or somewhat silvery pubescence. Antennae and tarsi slightly infuscated apically; basal abdominal tergites often with a dusky band along the posterior margin, seldom as dark and distinct as in *burrus*; tips of mandibles and extreme base of first abdominal segment black; occasionally there is some black on the bases of the coxae, the mesosternum, and the postnotum. Wings varying from light brownish, sometimes slightly tinged with yellowish, and darker along the outer margins, to wholly dark brownish; wings always somewhat violaceous. Structurally very similar to typical *ferrugineus,* but the mesosternum produced in front of the bases of the middle coxae into small, acute processes. These are not conspicuous, but provide a handy character for separating this form from *burrus,* since the difference in color is not great.

MALE.—Length 13 (12–15) mm. Color as in the female, but the wings much lighter. Wings very lightly tinged with brownish, their apices narrowly darker, and usually with a faintly darker area in the fore wing extending from the marginal cell through the submarginal cells into the 3d discoidal; vicinity of the basal vein also somewhat clouded. There is at most a very faint tinge of yellowish in the wings.

Distribution.—This form inhabits western Mexico and ranges north through the Lower Sonoran fauna of western Texas, New Mexico, Arizona, and southern California.

Specimens seen: 32 (22 ♀♀, 10 ♂♂). TEXAS: Brewster Co., 1 ♂, Chisos Mts., 5 July [OSC]; Jeff Davis Co., 7 ♀♀, Limpia Canyon, Davis Mts., some on *Baccharis glutinosus*, 20 July [HEE]; NEW MEXICO: 1 ♀ (no further data) [USNM]; ARIZONA: Cochise Co., 1 ♂, Douglas, 24 July [USNM]; Coconino Co., 1 ♀, Oak Creek Canyon, 6000 feet [MCZ]; Pima Co., 1 ♀, 1 ♂, Baboquivari Mts., July, Oct. [CAS]; 1 ♀, 1 ♂, Bear Canyon, Santa Catalina Mts, 4 Aug. [HEE]; 2 ♂♂, Tucson [MCZ, CU]; 1 ♀, Ventana Canyon, Santa Catalina Mts., 30 Aug. [USNM]; southern part, 6 ♀♀ [MCZ]; CALIFORNIA: Imperial Co., 1 ♀, Westmoreland, 15 May [CIS]; Riverside Co., 1 ♀, Palm Springs, 30 Oct. [CAS]; 1 ♂, Pinon Flat, San Jacinto Mts., 18 June [CAS]; San Bernardino Co., 1 ♂, Boyer Ranch, 29 Palms [MCZ]; 1 ♀, 1 ♂, Mill Creek Canyon, 21 Sept. [CAS]; MEXICO· Baja California, 1 ♀, Las Animas, Sierra Laguna, 12 Oct. [CAS]; 1 ♂, 15 mi. No. of San Ignacio, 29 Sept. [CAS].

2a. **Tachypompilus torridus torridus** (Smith) new combination

(Plate XV, fig. 56; plate XVI, fig. 62.)

Pompilus torridus Smith, 1862, Journal Ent., 1: 396. [Type: ♀; "Mexico"; British Museum (not seen by author).]—Cresson, 1867, Trans. Amer. Ent. Soc., 1: 110.—Cresson, 1869, Proc. Boston Soc. Nat. Hist., 12: 371. [Orizaba, Mex.]—Cameron, 1893, Biol. Centr.-Amer., Hymen. II, pp. 211–212, pl. XI, figs. 28 and 28a.

Arachnophroctonus torridus Bradley, 1944, Notulae Naturae, Acad. Nat. Sci. Phila., no. 145, p. 9.

This is a somewhat smaller species than *ferrugineus*, although individuals are often as large as an averaged-sized *ferrugineus*. The antennae are distinctly shorter, segment 3 in the female not much if any exceeding the vertex width, segment 3 in the male from 1.5 to 2.1 × as long as its greatest thickness. The vertex is broader and the temples somewhat better developed than in *ferrugineus*. There are small processes on the mesosternum in the female which overlie the bases of the middle coxae. Typical *torridus* is best told by the nearly hyaline wings which are usually distinctly suffused with yellowish; the apical margins of both pairs are narrowly, contrastingly infuscated.

FEMALE.—Length 14.5 (11–18) mm.; color bright castaneo-ferruginous, overlaid with a fine pale pubescence. Tips of the mandibles black; apical few segments of antennae more or less infuscated; occasionally there is some black on the pleura, metanotum, postnotum, coxae, and propodeal declivity. Wings subhyaline, usually distinctly suffused with yellowish, especially toward the base; outer margins of both pairs of wings narrowly infuscated. Temples and propleura with some very light hair; there may also be erect hairs on the clypeus, front, vertex, front coxae, thoracic dorsum, and propodeum.

Clypeus about twice as broad as high, its apical margin broadly, shallowly emarginate. Temples moderately developed, in dorsal view not quite as thick as the eyes. Front rather broad, middle interocular distance varying from .56 to .63 × transfacial distance; frontal tubercle well-defined. Eyes converging slightly above, upper interocular distance from .85 to .95 × the lower. Ocelli in a flat triangle; post-ocellar line subequal to ocello-ocular line, or either may be slightly the greater. Antennae elongate, the first 4 segments in a ratio of about 6:2:12:9, segment 3 equal to from 1.0 to 1.2 × upper interocular distance.

Pronotum short, its posterior margin arcuate or very feebly angulate. Propodeum with a well-defined oblique declivity, flat or slightly concave, on each side of which it is more or less humped; median line distinctly impressed in front. Mesosternum bearing small acute lobes just in front of the bases of the middle coxae. Tarsal comb strong, as in *ferrugineus*, but there are usually only 3 comb-spines on the basitarsus, sometimes 4. Wing venation not differing noticeably from that of *ferrugineus*.

MALE.—Length 10 (8–12) mm.; coloration as in the female, except that the mesosternum, hind coxae in front, and sometimes the postnotum, the pleural sutures, and the posterior part of the propodeum may be blackish. Wings nearly clear hyaline, lightly suffused with yellowish or pale yellow-brown, the outer margins narrowly infuscated. Pubescence pale brownish or silvery; front, vertex, temples, propleura, and to a lesser extent the pronotum, front coxae, and propodeum, with very fine, short, pale hairs.

Clypeus about twice as broad as high, its apical margin truncate. Front broad, middle interocular distance from .6 to .65 × transfacial distance. Inner orbits diverging slightly above, upper interocular distance from 1.05 to 1.2 × lower interocular distance. Ocelli small, in a broad triangle, post-ocellar line usually slightly greater than ocello-ocular line. Front with a small but distinct tubercle just above the antennal bases, and a faint line extending from it to the front ocellus. Antennae of moderate length, the first 4 segments in a ratio of about 6:2:5:5, segment 3 from 1.7 to 2.1 × as long as its greatest thickness, the first 3 segments together about equal to upper interocular distance.

Pronotum and propodeum shaped much as in the female; postero-lateral corners of the propodeum gibbous, barely protuberant. Characters of the abdomen much as in *ferrugineus*, and the genitalia very similar to those of that species. However, the aedoeagus is somewhat broader and apically less attenuate than in this species, and the spines along the shaft are considerably shorter, not extending beyond the margins of the aedoeagus (fig. 62).

Biology.—This form inhabits desert and semidesert areas of the deep Southwest. I have taken it on the flowers of *Asclepias, Avicennia nitida,* and *Sphaeralcea angustifolia.*

Distribution.—Typical *torridus* is widely distributed in Mexico, but enters the United States only in the extreme southern parts of Texas, New Mexico, Arizona, and California. North of this, and west of New Mexico, it is replaced by subspecies *unicolor* Banks.

Specimens seen: 25 (18 ♀♀, 7 ♂♂). TEXAS: Cameron Co., 2 ♂♂, Brownsville [USNM]; 2 ♀♀, Port Isabel, 23 June [HEE]; Culberson Co., 1 ♀, Van Horn, 24 June [CAS]; Jeff Davis Co., 2 ♂♂, 6–10 mi. W. of Fort Davis, 12–23 July [HEE]; Presidio Co., 1 ♀, Marfa, 20 July [HEE]; Taylor Co., 1 ♀, 2 Sept. [CIS]; NEW MEXICO: Dona Ana Co., 1 ♀, Las Cruces, 12 July [ANSP]; ARIZONA: Cochise Co., 1 ♀, 1 ♂, Douglas, July [HEE, USNM]; Pinal Co., 2 ♀♀, 1 ♂, Florence [ANSP]; CALIFORNIA: San Diego Co., 1 ♀, Red Mt., nr. Fall Brook, 1025 feet, 19 Aug. [ANSP]; MEXICO: Baja California, 1 ♂, Mesquital, 22 June [CAS]; 2 ♀♀, 10 mi. E. of Mesquital, 23 June [CAS]; 3 ♀♀, 20 mi. No. of Mesquital, 27 Sept. [CAS]; Chihuahua, 1 ♀, Samalayuca, 24 June [AMNH]; Mexico, 1 ♀, Teotehuacan, 24 Mch. [Minn.]; State unknown, 1 ♀, Tiahualilo, July [USNM].

2b. **Tachypompilus torridus unicolor** (Banks) new combination

Arachnophroctonus ferrugineus Woodworth, 1913, Guide to Calif. Insects, p. 99.—Banks, 1919, Bull. Mus. Comp. Zool., 63: 239–240.

Arachnophroctonus unicolor Banks, 1919, Bull. Mus. Comp. Zool., 63: 239, 240. [Lectotype: ♀; Wenass Valley, Wash., 6 July 1882; M.C.Z.] [50]

Arachnophroctonus latifrons Banks, 1939, Canad. Ent., 71: 229. [Type: ♀; Wenass Valley, Wash., 6 July 1882; M.C.Z. no. 23,474.] New synonymy.

This form is very similar to typical *torridus,* but the wings are wholly brownish; the body may be wholly ferruginous or more or less marked with black; males are occasionally marked with as much black as *ferrugineus ferrugineus,* rarely as much as in

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[50] Banks credits this species to Viereck, but the latter had never described it; this is therefore the first appearance of the species in print, and since Banks places it in a key, I believe it may be considered a description. Of the four specimens Banks had before him, the above mentioned is hereby designated the type; this same specimen is also the type of *latifrons* Banks. In 1944 Banks, apparently realizing that *unicolor* had never been "officially" described, published a description, based on specimens from Arizona which I consider specifically distinct from his earlier *unicolor.* On a previous page I have, therefore, proposed a new name for *unicolor* Banks 1944, *nec* Banks 1919.

nigrescens. This is a common wasp in the Pacific states, and is the only *Tachypompilus* known to reach Canada (Okanagan Valley, B. C.).

FEMALE.—Length 16 (10–21) mm. Color in general bright castaneo-ferruginous, overlaid with a very fine pale pubescence. The minimum amount of black which may be present is as follows: tips of mandibles, apices of the antennae, and extreme base of the first abdominal segment. The maximum amount of black on any specimen before me is as follows: tips of mandibles, cheeks and lower temples, lower front below, between, and just above the antennal orbits, a blotch covering the ocelli, occiput, propleura, base and apex of front coxa, a median blotch on the anterior part of the pronotum; anterior third of the mesonotum; sides of the scutellum and metanotum; all of the postnotum, metapleura, and propodeum; greater part of the mesopleura and middle and hind coxae and trochanters; basal fourth of first abdominal segment; apices of antennae and legs. In general, most of the darker specimens are from the northern parts of the range, though some northern specimens have very little black on them. Wings pale to dark brownish, somewhat violaceous, the outer margins very slightly darker.

Third antennal segment shorter than, equal to, or a little longer than upper interocular distance (.85 to 1.15 × the latter). Contours of the propodeum somewhat variable, but the declivity always well-defined, and the surface of the propodeum always somewhat gibbous on each side of the declivity.

MALE.—Length 11 (6.5–14) mm.; color much like that of the female, except that some specimens have even more black on them than the extremes in that sex: almost the entire head and thorax may be blackish; the abdomen, however, never possesses bands of black at the apices of the segments as in several subspecies of *ferrugineus.* Wings colored as in the female. Head, thorax, and propodeum with a considerable amount of short, pale hair, especially noticeable on the front and vertex. Pronotum rather abruptly declivous in front; postero-lateral corners of the propodeum scarcely protuberant; abdomen short, compact.

Biology.—This form has been taken on the flowers of *Asclepias, Eriogonum,* and *Cicuta.* In the northern parts of its range there is a single yearly generation, the adults occurring in July and August; in the South it occurs from April until November, and there is undoubtedly more than one generation during this time.

Distribution.—This subspecies occurs from southern California and Utah north to Wyoming, Idaho, and British Columbia, principally in the Upper Sonoran fauna and the upper portion of the Lower Sonoran.

Specimens seen: 279 (211 ♀♀, 68 ♂♂). The following records appear to be marginal: CALIFORNIA: San Diego Co., 16 ♀♀, 15 ♂♂, La Jolla, June, Aug. [USNM]; Riverside Co., 2 ♂♂, 10 mi. SW. of Hemet, 19 July [CIS]; Kern Co., 1 ♀, Kernville, 24 July [UK]; NEVADA: Washoe Co., 4 ♀♀, Reno, 4 July-10 Aug. [CIS]; UTAH: Utah Co., 2 ♀♀, July, Aug. [CIS]; Cache Co., 10 ♀♀, 1 ♂, Logan, 17 July-1 Aug. [UAC]; WYOMING: Sweetwater Co., 1 ♀, Green River, 6100 feet, 2 July [AMNH]; IDAHO: Ada Co., 1 ♀, Boise, 30 July [USNM]; WASHINGTON: Whitman Co., 2 ♀♀, Wawawai, 18 Aug. [MCZ, USNM]; Yakima Co., 1 ♀, Wenass Valley, 6 July [MCZ]; BRITISH COLUMBIA: 3 ♀♀, Okanagan Falls, 20-24 July 1917 [CNC]; 1 ♀, Oliver, 17 July [CNC]; 1 ♀, Peachland, 23 July [MCZ]. There are no records from west of the Cascades and Coast Ranges north of Sonoma Co., Calif., the dry interior being the principal home of this form.

EXPLANATION OF FIGURES

PLATE X

Fig. 1.—Head of *Anoplius relativus* (Fox), showing terminology of parts: FD, facial distance; LID, lower interocular distance; MID, middle interocular distance; OOL, ocello-ocular line; POL, post-ocellar line; TFD, transfacial distance; UID, upper interocular distance.

Fig. 2.—Male genitalia of *Anoplius relativus* (Fox), showing terminology of parts: *ae*, aedoeagus; *ap*, apodeme of aedoeagus; *ba*, basis volsellaris; *bh*, basal hooklets; *co*, cardo; *dt*, digitus volsellaris; *pl*, parapenial lobes; *pr*, parameres; *sq*, squama.

Fig. 3.—*Evagetes parvus* (Cresson), front tarsus of female.

Fig. 4.—*E. hyacinthinus* (Cresson), front tarsus of female.

Fig. 5.—*E. subangulatus* (Banks), front tarsus of female.

Fig. 6.—*E. padrinus* (Viereck), front tarsus of female.

Fig. 7.—*E. ingenuus* (Cresson), last segment of hind tarsus of female.

Fig. 8—*E. crassicornis* (Shuckard), inner lateral view of last segment of front tarsus of male.

Fig. 9.—*Chalcochares englehartі* (Banks), front tarsus and apex of front tibia of female.

PLATE XI

Fig. 10.—*C. hirsutifemur* (Banks), wings.

Fig. 11.—*Tastiotenia festiva* new species, wings.

Fig. 12.—*Evagetes ingenuus* (Cresson), wings.

Fig. 13.—*E. parvus* (Cresson), hind wing.

Fig. 14.—*Chalcochares hirsutifemur* (Banks), lateral aspect of head of male.

Fig. 15.—*C. engleharti* (Banks), lateral aspect of head of male.

Fig. 16.—*C. engleharti* (Banks), male genitalia.

Fig. 17.—*C. hirsutifemur* (Banks), male genitalia.

Fig. 18.—*Evagetes dubius* (Van der Linden), male genitalia.

PLATE XII

Fig. 19.—*E. ingenuus* (Cresson), male genitalia.
Fig. 20.—*E. parvus* (Cresson), male genitalia.
Fig. 21.—*E. hyacinthinus* (Cresson), male genitalia.
Fig. 22.—*E. crassicornis* (Shuckard), male genitalia.
Fig. 23.—*E. subangulatus* (Banks), male genitalia.
Fig. 24.—*E. padrinus* (Viereck), male genitalia.

PLATE XIII

Fig. 25.—*E. hyacinthinus* (Cresson), dorsal aspect of head and pronotum of female.
Fig. 26.—*E. crassicornis* (Shuckard), dorsal aspect of head and pronotum of female.
Fig. 27.—*E. parvus* (Cresson), dorsal aspect of pronotum of female.
Fig. 28.—*E. padrinus* (Viereck), male subgenital plate.
Fig. 29.—*E. ingenuus* (Cresson), basal five segments of antenna of male.
Fig. 30.—*E. padrinus* (Viereck), basal five segments of antenna of male.
Fig. 31.—*E. parvus* (Cresson), basal five segments of antenna of male.
Fig. 32.—*E. crassicornis* (Shuckard), male subgenital plate.
Fig. 33.—*E. parvus* (Cresson), male subgenital plate.
Fig. 34.—*E. dubius* (Van der Linden), male subgenital plate
Fig. 35.—*E. subangulatus* (Banks), basal five segments of male antenna.
Fig. 36.—*Agenioideus* (*Ridestus*) *biedermani* (Banks), apex of hind tarsus of female.
Fig. 37.—*A.* (*Agenioideus*) *humilis* (Cresson), male subgenital plate, lateral view.
Fig. 38.—*A.* (*Gymnochares*) *birkmanni* (Banks), male subgenital plate, lateral view.

PLATE XIV

Fig. 39.—*A.* (*Agenioideus*) *humilis* (Cresson), male genitalia.
Fig. 40.—*A.* (*Ridestus*) *biedermani* (Banks), male genitalia.
Fig. 41.—*A.* (*Gymnochares*) *birkmanni* (Banks), male genitalia.
Fig. 42.—*Sericopompilus neotropicalis* (Cameron), male genitalia.
Fig. 43.—*Poecilopompilus algidus* (Smith), male genitalia.
Fig. 44.—*P. interruptus* (Say), male genitalia.

PLATE XV

Fig. 45.—*Sericopompilus neotropicalis* (Cameron), head of female.
Fig. 46.—*S. apicalis* (Say), head of female.
Fig. 47.—*S. angustatus* (Cresson), head of female.
Fig. 48.—*S. apicalis* (Say), dorsal aspect of head of male.
Fig. 49.—*S. neotropicalis* (Cameron), dorsal aspect of head of male.
Fig. 50.—*Episyron oregon* new species, dorsal aspect of head of male.
Fig. 51.—*E. biguttatus* (Fabricius), dorsal aspect of head of male.
Fig. 52.—*E. biguttatus* (Fabricius), head of female.
Fig. 53.—*E. oregon* new species, head of female.
Fig. 54.—*Tachypompilus ferrugineus* (Say), lateral aspect of head and prothorax of female.
Fig. 55.—*T. ferrugineus* (Say), lateral aspect of head of male.
Fig. 56.—*T. torridus* (Smith), basal segments of antenna of male.
Fig. 57.—*T. ferrugineus* (Say), antenna of female.

PLATE XVI

Fig. 58.—*Agenioideus* (*Agenioideus*) *humilis* (Cresson), wings.
Fig. 59.—*Sericopompilus apicalis* (Say), wings.
Fig. 60.—*Episyron biguttatus* (Fabricius), wings.
Fig. 61.—*E. quinquenotatus* (Say), male genitalia.
Fig. 62.—*Tachypompilus torridus* (Smith), aedoeagus of male.
Fig. 63.—*Episyron biguttatus* (*Fabricius*), outer aspect of segments 8, 9, and 10 of male antenna.
Fig. 64.—*E. oregon* new species, outer aspect of segments 8, 9, and 10 of male antenna.
Fig. 65.—*E. posterus* (Fox), outer aspect of segments 8, 9, and 10 of male antenna.
Fig. 66.—*E. snowi* (Viereck), outer aspect of segments 8, 9, and 10 of male antenna.
Fig. 67.—*Tachypompilus ferrugineus* (Say), male genitalia.
Fig. 68.—*T. analis* (Fabricius), male genitalia.
Fig. 69.—*Sericopompilus apicalis* (Say), postnotum of female.
Fig. 70.—*Poecilopompilus algidus* (Smith), postnotum of female.
Fig. 71.—*Tachypompilus ferrugineus* (Say), mandible of female.

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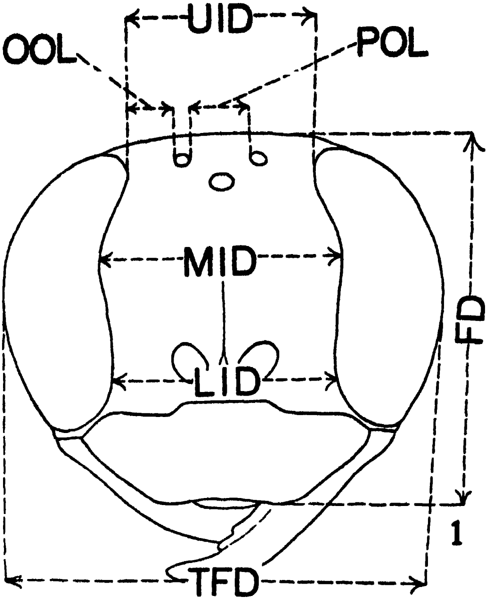

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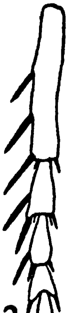

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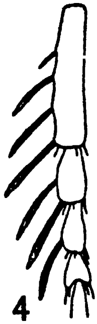

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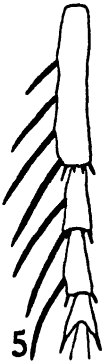

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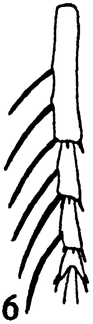

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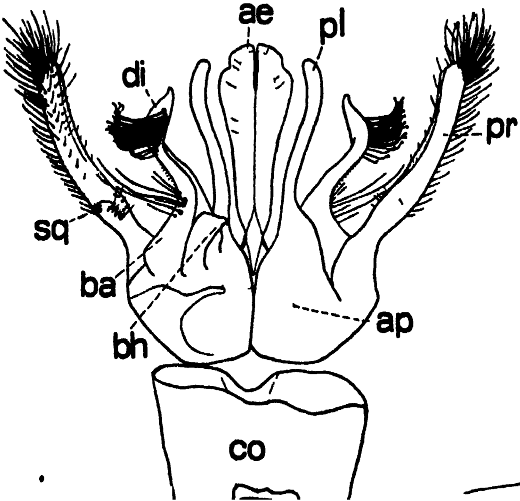

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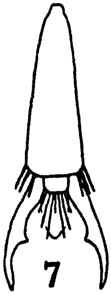

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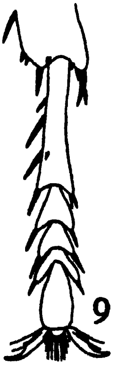

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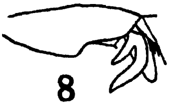

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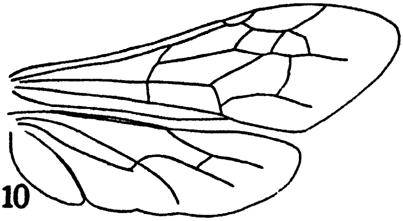
EVANS—NEARCTIC SPIDER WASPS



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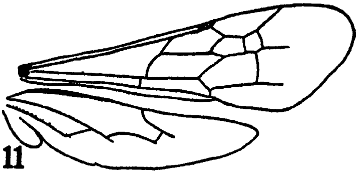

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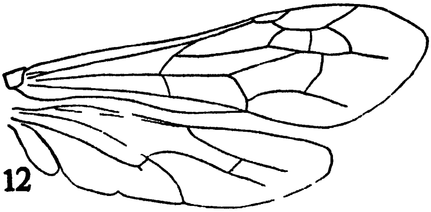

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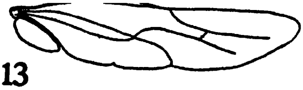

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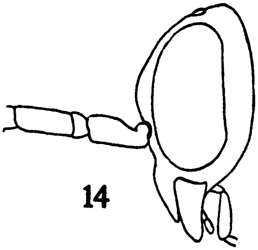

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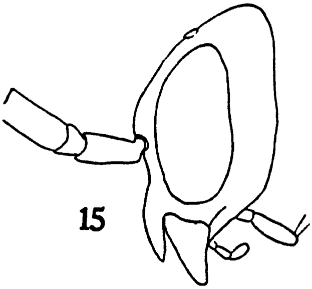

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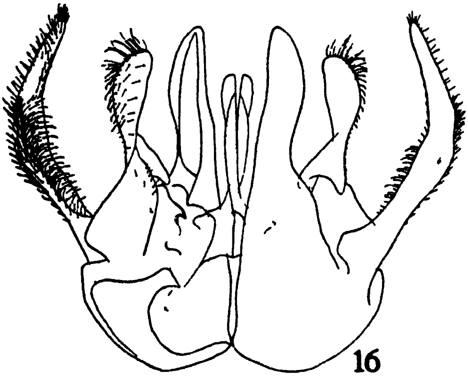

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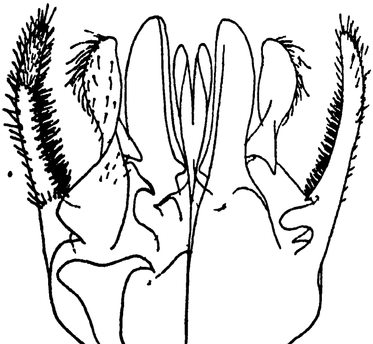

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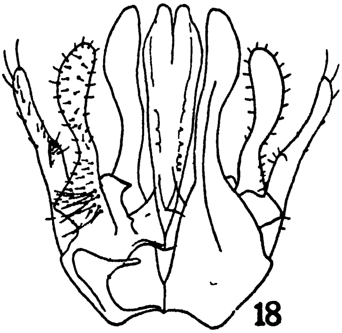

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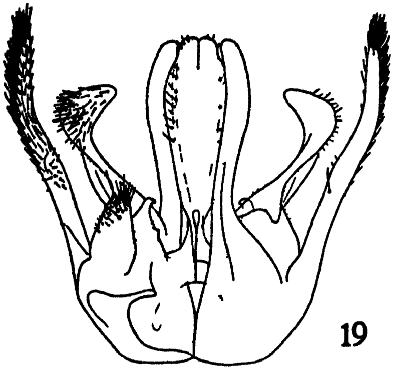
EVANS—NEARCTIC SPIDER WASPS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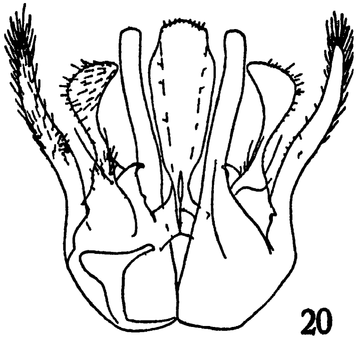
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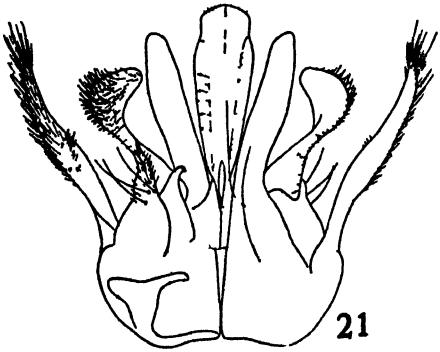
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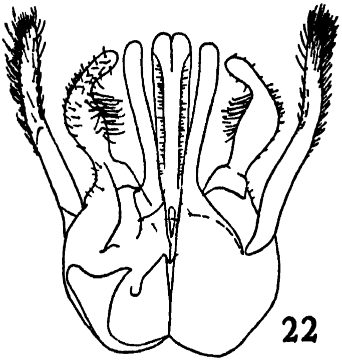
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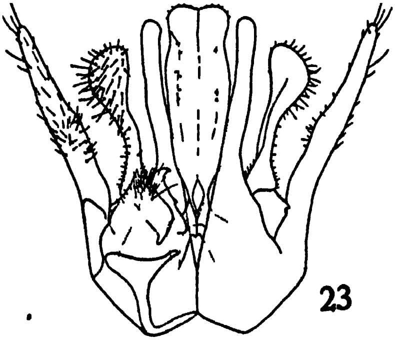
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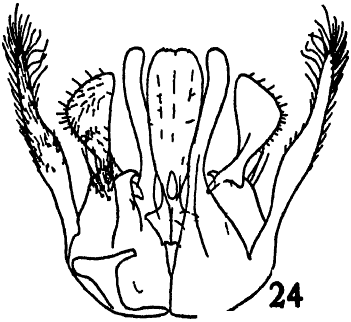
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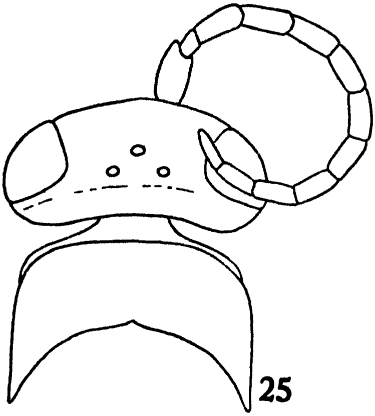
EVANS—NEARCTIC SPIDER WASPS



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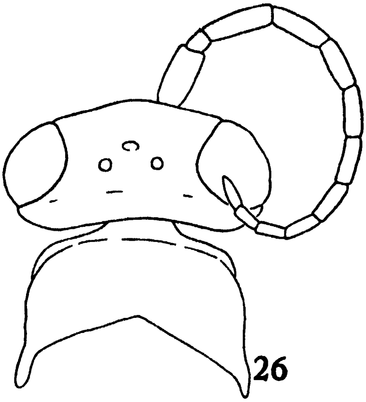

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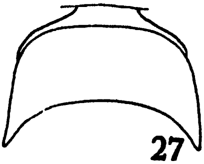

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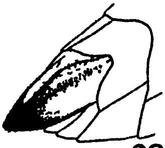

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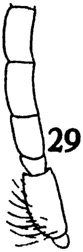

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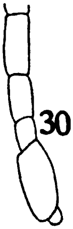

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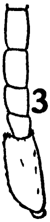

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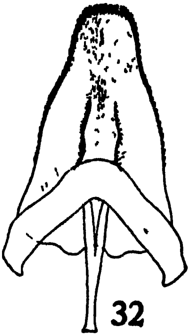

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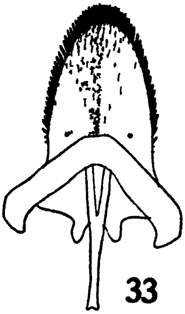

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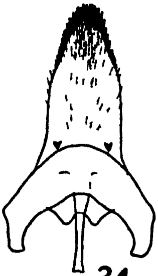

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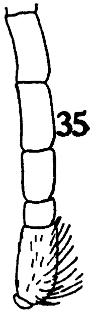

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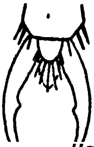

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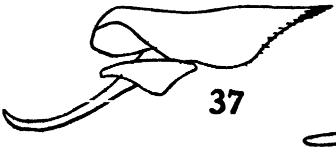

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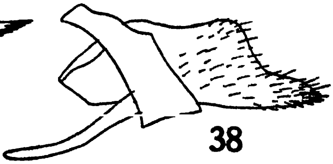

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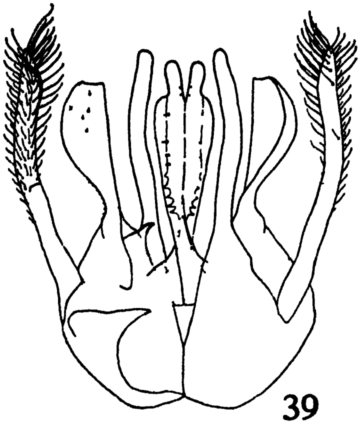
EVANS—NEARCTIC SPIDER WASPS



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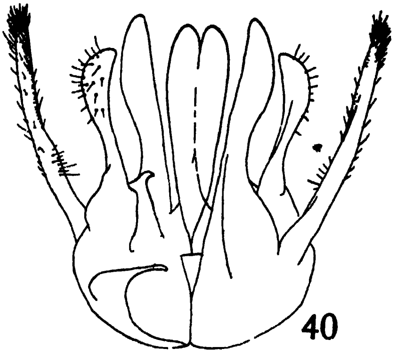

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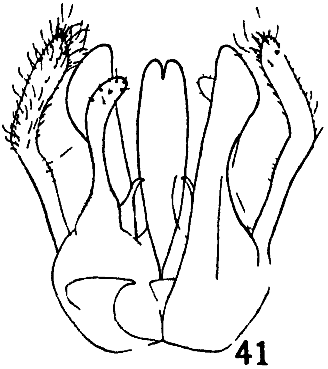

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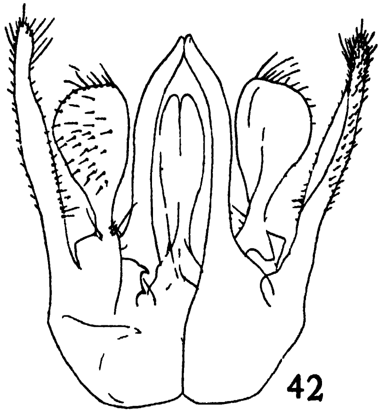

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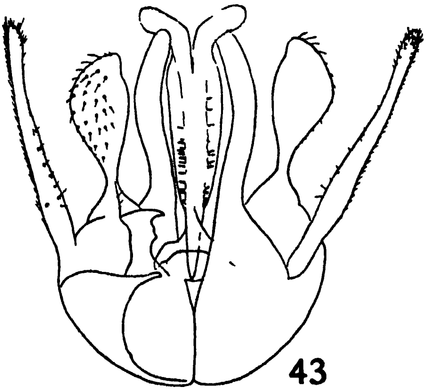

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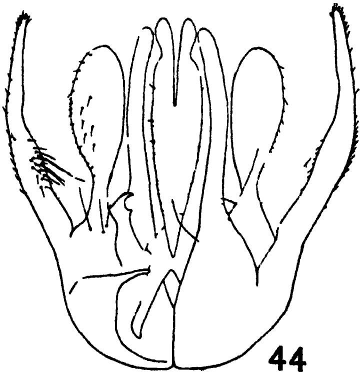

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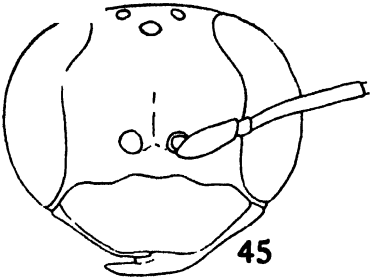

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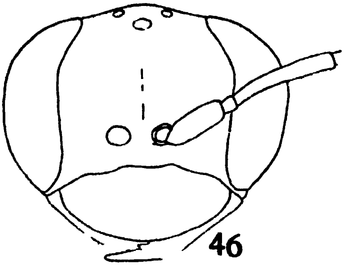

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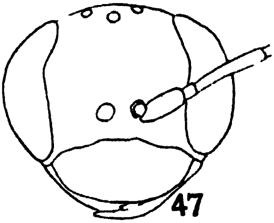

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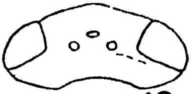

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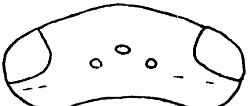

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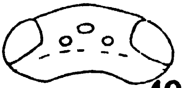

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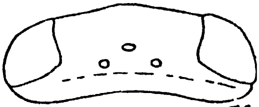

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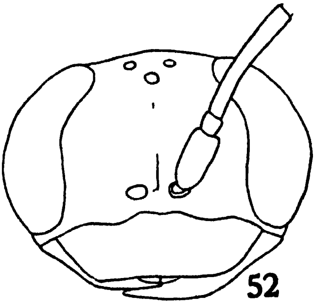

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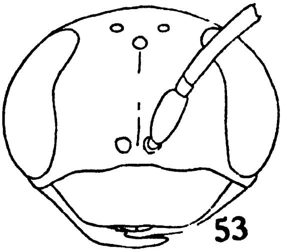

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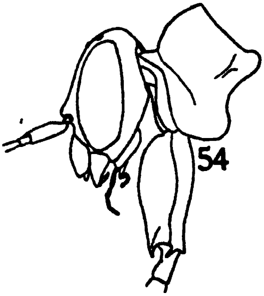

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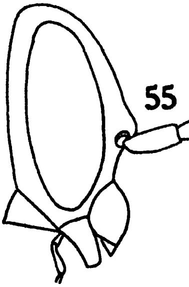

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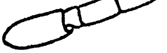

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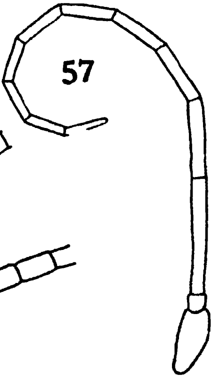

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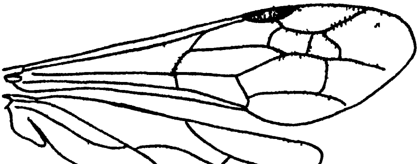
EVANS—NEARCTIC SPIDER WASPS



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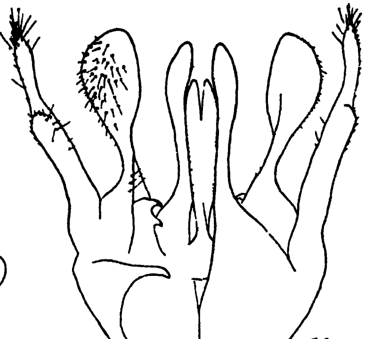

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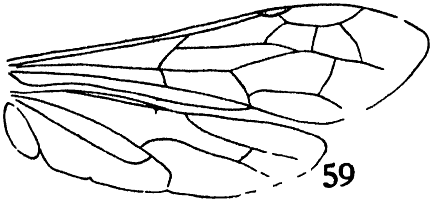

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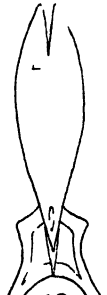

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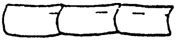

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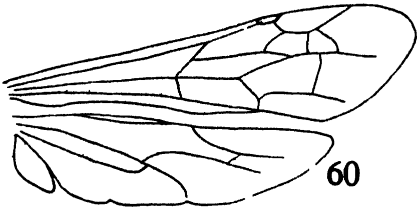

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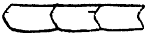

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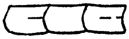

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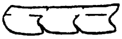

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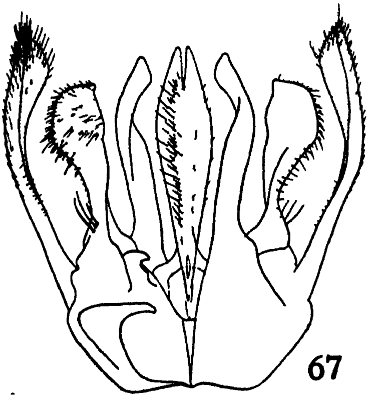

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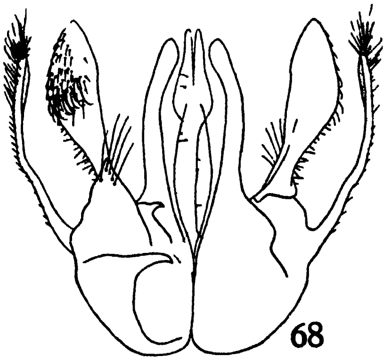

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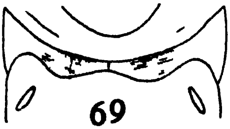

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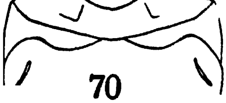

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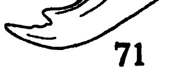

71

STUDIES IN THE GROUP DYSONIAE (APHIDNIAE OF AUTHORS) (ORTHOPTERA: TETTIGONIIDAE: PHANEROPTERINAE)

(PART I)

BY JAMES A. G. REHN

Curator of Insects, The Academy of Natural Sciences of Philadelphia

(Plates XVII to XIX and text-figures)

In 1878 Brunner von Wattenwyl[1] created the group Aphidniae to include four genera, *Hammatofera, Oxyprora, Machima* and *Aphidnia* (an emendation of *Aphidna*), all but the latter of which were then described as new. Of *Hammatofera* he was acquainted with two species from Brazil, of *Oxyprora* one from Peru, of *Machima* three, one from Brazil and two from Colombia, and in *Aphidnia* (correctly *Aphidna*) of Stål he placed seven species, all but one described as new, from Brazil, Colombia and Mexico. When his "Additamenta" appeared in 1891[2] he had no additions to make, either in genera or species, to those included by him in the group in 1878.

In 1898 Karsch described *Machima hygracantha* from Colombia,[3] and Giglio-Tos in 1898, after pointing out that *Oxyprora* as used by Brunner was preoccupied by *Oxyprora* Stål of 1873,[4] used for a neotropical copiphorid, replaced it with *Oxyprorella*,[5] also adding the new species *O. dives* from eastern Ecuador. The same author also described the new genus *Paraphidnia*,[6] which he compared with *Aphidnia* (i.e., *Aphidna*), and placed in it the single new species *P. gallina,* also from eastern Ecuador.

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[1] Monographie der Phaneropteriden, pp. 18, 146.

[2] Verb. k.-k. zool.-bot. Gesell., Wien, XLI, p. 9.

[3] Entom. Nachr., XXII, p. 346.

[4] Öfv. K. Svenska Vet.-Akad. Förhandl., XIII, (4), p. 50.

[5] Boll. Mus. Zool. Anat. Comp. Univ. Torino, XIII, no. 311, pp. 68, 69. Unfortunately I. Bolívar overlooked this substitute name of Giglio-Tos, and in 1906 (Bol. Soc. Españ. Hist. Nat., VI, p. 392) he proposed *Oxypila* to replace the preoccupied *Oxyprora* of Brunner.

[6] Idem, pp. 68, 70.

Kirby in 1906, in his "Synonymic Catalogue of Orthoptera"[7] pointed out that the generic name *Markia* had been proposed by White as far back as 1862 for one of the components (*hystrix* Westwood, 1841) of Brunner's 1878 genus *Machima,* which latter, however, he regarded as composite generically, and by indicating the species *phyllacantha* Burmeister, 1838, as the genotype of *Machima,* he retained the two as distinct genera. He also pointed out[8] that White's name *Dysonia,* 1862,[9] was an older name for the generic entity for which Brunner had used Stål's name *Aphidna* (or as emended by Brunner *Aphidnia*). Brunner's *Aphidnia verrucosa,* from Brazil, was also shifted to the genus *Paraphidnia.* Unfortunately Kirby added to possible confusion in the use of the name *Oxyprora* by entering Giglio-Tos' *Oxyprorella* twice in his catalogue, once in its proper place next to *Machima,*[10] and also in another subfamily,[11] as an independent genus near the true *Oxyprora* of Stål!

In 1915 L. Bruner[12] described two new species of *Oxyprorella,* one, *O. zebrata,* from eastern Bolivia, the other, *O. modesta,* from Rio de Janeiro, Brazil, and in the same paper[13] he also described *Dysonia* (?) *lamellipes* from eastern Bolivia on the basis of a single immature female. In 1918 Rehn described *Paraphidnia lankesteri*[14] from eastern Costa Rica. Finally in 1927 Hebard added the genus *Quiva,*[15] based on a single species (*Q. diaphana*) from Colombia, tentatively also placing in it Brunner's *Hammatofera abacata* of 1878, to which latter genus he considered *Quiva* nearest in relationship.

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[7] Volume II, p. 410.

[8] Idem, p. 411.

[9] In "Richardson's Mus. Nat. Hist., II, p. 244, (1862)." (Type by original designation, *Dysonia albipes* (Westwood).) I have been unable to consult the original edition of this work, but have examined a subsequent one (1890) which has the same text and pagination as the original.

[10] Synon. Catal. Orth., II, p. 410.

[11] Idem, p. 236.

[12] Ann. Carneg. Mus., IX, pp. 300–301.

[13] Idem, p. 302.

[14] Trans. Amer. Entom. Soc., XLIV, p. 345, pl. XVIII, figs. 20–23.

[15] Idem, LII, p. 276, pls. VIII, fig. 1, XX, figs. 1 and 2, XXII, fig. 1.

The above items summarize our knowledge of the systematic history of the components of the group since it was erected in 1878. Due to the antedating of the name *Aphidnia* by *Dysonia* the assemblage may with propriety be referred to as the Dysoniae.

As individuals of all the genera involved never appear to be numerous in nature, they are generally secured as single specimens, sometimes at light. Information sent in with these single individuals is sometimes to the effect that they were the first the collector had seen in years of residence.

Personal field work, extending over a number of months during five different years, in areas where the group is known to occur, has never yielded me a specimen of any of the genera, although entomological friends there have sent me one now and then as rarities in their experience. Slowly the representation of the group in the Philadelphia collection has grown over a period of nearly five decades, until now it is scientifically of particular importance although numerically limited.

The present study is not put forward as a comprehensive revision, but merely as a contribution which broadens our knowledge of the group, and at this time I am not discussing the genera *Markia, Dysonia* and *Paraphidnia*, reserving these for future treatment in other parts of the series. I am unacquainted with *Hammatofera* or *Oxyprorella* other than through the literature, so the present discussion deals with the previously-known genera *Quiva* and *Machima*, and new generic entities here described, the treatment thus dealing with species of five genera, of which seven species and three genera are new. The types of all the new forms here described are in the collections of the Academy of Natural Sciences of Philadelphia, except for that of one species which is the property of the Vienna Museum, and for the privilege of examining this I am indebted to the kindness and cooperation of Dr. Max Beier.

Brunner's 1891 key to the genera of the Phaneropterinae [16] will be found of service in recognizing the members of this group, although it is probable future work will show that certain features utilized in his key for major divisions are of less fundamental value than he assumed. Lawrence Bruner in 1915 transcribed this key as far as it concerned New World genera,[17] and added such additional ones as had been described or recognized subsequent to 1891. The present key replaces that of Bruner as found between sections "bb" and "cc" on page 288 of his paper. As constructed it is intended merely to supply a means for the determination of the genera, and their sequence in it does not represent my idea of a proper linear arrangement of the genera studied. The latter will be given in the final part of this series of studies.

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[16] Verh. k.-k. zool.-bot. Gesell., Wien, XLI, pp. 3–24 (Dysoniae (as Aphidniae) on p. 9).

Key to the Genera of the Dysoniae

1. Caudal femora with ventro-external margin at most only spinulose, neither long spined nor lobate..2
Caudal femora with both ventral margins either long spined or lobate, but not spinulose..4
2. Antennae nodose. Fastigium of the vertex compressed, acuminate. Caudal femora with genicular lobes obtuse..........**Hammatofera** Brunner [18]
Antennae not nodose (but annulate with fuscous). Fastigium of vertex sulcate dorsad. Caudal femora with genicular lobes either long or short dentate..3
3. Caudal femora with genicular lobes long dentate. **Oxyprorella** Giglio-Tos [18]
Caudal femora with genicular lobes brevidentate..........**Quiva** Hebard
4. Caudal femora and tibiae long spined [19]..............................5
Caudal femora lobate. Caudal tibiae armed with triangular teeth.......9
5. Pronotum not armed with spinose processes........................6
Pronotum armed medio-dorsad with several long compressed spinose processes..**Markia** White
6. Caudal femora with both genicular lobes markedly elongate, rod-like and spiniform, each subequal to or longer than the breadth of distal extremity of femur. Cephalic and median limbs not distinctly compressed, slender, the femora and tibiae more definitely rod-like........................7
Caudal femora with both genicular lobes spinigerous, but these are little produced, not rod-like, and very much shorter than the breadth of the distal extremity of femur. Cephalic and median limbs relatively stout in depth, appreciably compressed, not at all rod-like. (Fastigium roundly tuberculate, not cultriform produced. Pronotum with metazona lacking raised lateral, median and caudal cinguli or ridges.) **Yungasacris** new genus

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[17] Ann. Carneg. Mus., IX, pp. 286–297 (genera here discussed are on p. 288).

[18] As already stated I am unacquainted with this genus other than through the literature.

[19] These spines are somewhat compressed or flattened, but are in no sense truly or broadly lobate, and always have prolonged aciculate apices.

7. All pairs of genicular lobes of femora markedly elongate, rod-like and spiniform, in all cases longer than the breadth of distal portion of respective femora. All femora and tibiae with greatly elongate, compressed ventral marginal spines. (Fastigium compressed cultriform.) **Apolinaria** new genus

Genicular lobes of cephalic and median femora unequal in development, the cephalic (internal on cephalic pair, external on median pair) much the longer and moderately rod-like, the caudal one (external on cephalic femora, internal on median ones) very much shorter, or both are short and brevispinose. Cephalic and median femora and tibiae with such marginal spination as is present of the usual spinose type and never elongate nor compressed in character..............................8

8. Cephalic genicular lobe of cephalic and median femora markedly elongate, caudal one of each brevispinose. Vertex conically tuberculate, relatively short, and not cultriform nor subcultriform produced. Cerci of male elongate, caliper-like, moderately compressed. (Caudal femora with both ventral margins supplied with elongate compressed sublobate spines.)................. ....**Machima** Brunner

Both genicular lobes of cephalic and median femora relatively brevispinose. Vertex cultriform or subcultriform produced. Cerci of male much shorter, not compressed. (Caudal femora with one or both ventral margins supplied with elongate compressed sublobate spines.) **Machimoides** new genus

9. Vertex elevated into a spine. Antennae with their proximal article smooth...**Dysonia** White

Vertex elevated into a crest. Antennae with their proximal article armed. internally with a heavy robust obtuse tooth....**Paraphidnia** Giglio-Tos

PART I

THE GENERA QUIVA, MACHIMOIDES, MACHIMA, APOLINARIA AND YUNGASACRIS

QUIVA Hebard

1927. *Quiva* Hebard, Trans. Amer. Entom. Soc., LII, p. 276.

This genus is very readily recognized, due to the striking "polka-dot" color pattern of all the known species, the simple type of spinose armature of the genicular lobes (which, however, are bispinose) and of the caudal femoral margins, as well as the characteristic structure of the male cerci. Hebard considered it was more nearly related to *Hammatofera* than any other genus, and while, like him, I am unacquainted with the latter genus other than through the exceedingly unsatisfactory literature, *Quiva* can, at least for the time being, be placed in that location. Whether both Hebard and the present author are correct in placing in this genus one of the species described by Brunner as a *Hammatofera,* remains for the future to determine, as the very inadequately described type of that species is a female, and no material of that sex of any species of the present genus is before me.

The genus can readily be recognized from the preceding key to the genera and from Hebard's original generic diagnosis. There is, however, one feature worthy of note upon which the original describer was unable to comment, as the material before him lacked most of the antennae. Of the sixteen specimens of the genus now before me but a single one, that a male of *abacata* from Moengo, Surinam, has antennae with any degree of completeness. This shows that in *Quiva* the broad black annuli of at least the median portion of the antennae (the more distal portions being lacking) are appreciably dense micro-plumose on the dorsal surface when extended. The more proximal dark annuli lack this development and even mesad it is limited to a single aspect of the antennae.

Genotype (by original designation).—*Quiva diaphana* Hebard.

Key to Species of Quiva

1. Form as a whole somewhat more elongate; limbs, particularly median pair, more attenuate. Caudal margin of lateral lobes of pronotum more definitely oblique arcuate. Cerci of male in profile with their general form not evenly arcuate throughout, rather flattened mesad, shaft depth mesad subequal to or greater than depth at juncture of peduncle and shaft, armed dorso-distad with a conspicuous and elongate spiniform tooth, internal spinose production directed dorso-mesad and slightly recurved proximad...2

   Form as a whole less elongate; limbs, particularly median pair, less attenuate. Caudal margin of lateral lobes of pronotum more broadly arcuate with the ventral margin. Cerci of male in profile as a whole more evenly arcuate throughout, shaft depth mesad less than depth at juncture of peduncle and shaft, dorso-distad with a very short and blunt denticle, internal spinose production directed dorso-distad. (Ultimate abdominal tergite of male with its distal portion broadly produced mesad.) (Brazil; Guianas.).....................**abacata** (Brunner)

2. Ultimate abdominal tergite of male moderately produced mesad, its distal margin bisarcuate, these flanking a shallow median concave emargination. Male cerci more elongate, slender, caliper-like, their dorsal margin straight in profile and mesad subparallel to ventral margin, distal third not tapering as seen in profile, apex rather broad and distal margin oblique subtruncate, dorso-distal spine simple, straight. (Eastern Peru.) **pulchella** new species

Ultimate abdominal tergite of male much less produced, its distal margin not bisarcuate but as a whole very broadly and shallowly concave. Male cerci less elongate, stouter, more cultriform, dorsal margin in profile concave in median half of length, not at all parallel to ventral margin, distal third tapering as seen in profile and apex narrow, dorso-distal spine stout and subuncinate. (Colombia.)...........diaphana Hebard

Distribution.—Colombia (middle western slope of the Cordillera Oriental), Peru (upper Rio Huallaga of the Amazon drainage), French and Dutch Guiana, and "Brazil." The first mentioned area is at an elevation of approximately 6500 feet, several of the last mentioned ones are virtually at sea-level, hence the vertical range of the genus is considerable. It doubtless will be found in the extensive areas intervening between the specific regions from which it is now known. Zonally it is an inhabitant of both the Tropical and Subtropical biotic zones.

Quiva diaphana Hebard (Text-fig. 4.)

1927. *Quiva diaphana* Hebard, Trans. Amer. Entom. Soc., LII, p. 276, pls. XVIII, fig. 1, XX, figs. 1 and 2, XXII, fig. 1. [♀; Aguadita, Cundinamarca, Colombia.]

The unique male type of this species, in the collection of the Academy ex Hebard Collection, is now before me. The original description of the species fully serves for its recognition, although. a number of the features there given are shared with the other members of the genus. The pale tone, however, is creamy-white, and not a dead white as might be assumed from the original description. The very distinctive cerci have been well figured by the describer.

The type locality (Aguadita) is at an elevation of 1900 to 2000 meters (approximately 6500 feet) on the western slope of the Cordillera Oriental or Eastern Andes. It is near the well-known community of Fusagasugá and not far from the southern end of the Sabana de Bogotá. It is definitely a Subtropical Zone locality.

Quiva pulchella[20] new species (Text-figs. 1–3; pl. XVII, figs. 22 and 23.)

This species is in general more nearly related to *Q. diaphana* than it is to *abacata*, and can at once be distinguished by the features given in the preceding key. The structure of the male cerci, with

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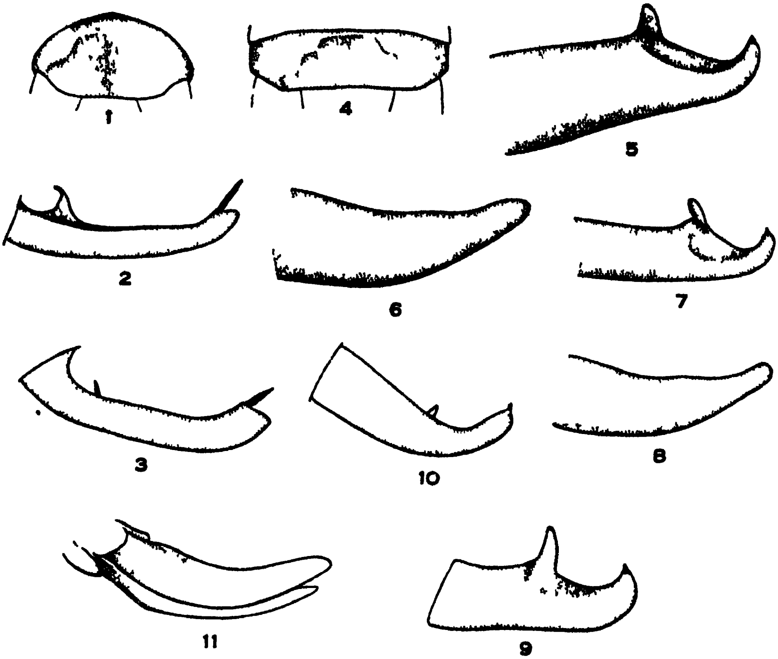
[20] In allusion to its form and color pattern.



Quiva pulchella new species. ♂ (type). Leonpampa, Peru. Fig. 1—Dorsal aspect of ultimate tergite. Fig. 2.—Dorsal view of left cercus. Fig. 3.—Lateral view of left cercus.

Quiva diaphana Hebard. ♂ (type). Aguadita, Colombia. Fig 4.—Dorsal aspect of ultimate tergite.

Machimoides vivasi new genus and species. ♂ (type). San Esteban, Venezuela. Fig. 5.—Dorsal view of left cercus. Fig. 6.—Lateral view of left cercus.

Machimoides minarum new genus and species. ♂ (type). Lassance, Minas Gerais, Brazil. Fig. 7.—Dorsal view of left cercus. Fig. 8.—Lateral view of left cercus.

Machimoides yuracare new genus and species. ♂ (type). Songo, Bolivia. Fig. 9.—Dorsal view of left cercus. Fig. 10.—Lateral view of left cercus. ♀ (allotype). Songo, Bolivia. Fig. 11.—Ovipositor.

(All greatly enlarged.)

their elongate form, straighter and non-tapering shaft and subtruncate distal extremity, with its marked simple and straight dorso-distal spine, is very distinctive. In addition to the features given in the key the fastigia of both the vertex and face are somewhat broader proximad, the limbs are somewhat more elongate proportionately, the tegmina are more rounded distad, and the subgenital plate of the male is more elongate and narrower mesad.

Type.—♂; Leonpampa, 110 kilometers east of Huanuco, Huanuco Province, Peru.[21] December, 1937. (Felix Weytkowski; "in tropical jungle.") [Academy of Natural Sciences of Philadelphia, Type no. 5757.]

Size medium (overall length, 34 mm.); form slender; surface generally smooth, areally polished, tegmina and wings except for dark maculations vitreous hyaline.

Head (as characteristic of the genus) relatively broad, the greatest breadth across eyes subequal to head depth (as 82 to 80), greatest breadth across genae immediately ventrad of eyes equal to three-fourths of head depth, the dorsal portion of the genae and face subbullate as in the other species of the genus, the whole head thence ventrad narrowing to the buccal apex; fastigium of face, closely embraced by the internal cingulate borders of the antennal scrobes as usual in genus, trigonal in outline, its depth subequal to its ventral breadth, the ascending converging borders shallowly concave, the dorsal apex narrowly rounded and subtuberculate, surface of the greater part of the facial fastigium occupied by the large circular but deplanate median ocellus; fastigium of vertex with approximately the same proportions as that of face, its distad-converging lateral margins, as seen from dorsum, similarly concave, and these largely made up of the surfaces of the large concave paired ocelli, the very narrowly rounded apex slightly deflexed as seen in profile, well separated from the fastigium of the face and with its dorsal surface non-sulcate. Eyes moderately exserted, relatively large, subglobose, in outline faintly longer than deep. Antennae incomplete.[22]

Pronotum with its medio-dorsal length equal to slightly less than double the greatest breadth of the metazonal section of the disk (as 76 to 52), subsellate in form but dorsum nearly straight in profile and not concave on the prozona, surface of lateral lobes nearly vertical, rounding into dorsum without any marked angulation; cephalic margin of pronotal disk evenly arcuate, caudal margin of same arcuate but somewhat flattened mesad and with a subobsolete, small and very shallow median emargination, surface of disk broadly arcuate transverse cephalad, mesad with a very short but well-impressed medio-longitudinal sulcation, which is bisected by a V-shaped remnant of a transverse sulcus, between the humeral (tegminal) sinuses there extends across the disk a shallow but distinct transverse impression, while very briefly near the caudal margin the disk bears a weak medio-longitudinal carinula; lateral lobes roughly subequal in length and depth, the cephalic margin distinctly concave in dorsal half, rather sharply rounding over the ventro-cephalic point to the broadly arcuate ventral margin, which passes evenly dorso-caudad into the caudal margin of the lobes, which latter are weakly subsinuate ventrad of the subacute-angulate humeral (tegminal) sinus, margins of the lateral lobes more markedly cingulate than those of the pronotal dorsum, surface of the lateral lobes with at most shallow and incomplete remnants of transverse sulci.

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[21] I have already discussed at some length the possible position of this locality (Trans. Amer. Entom. Soc., LXVIII, p. 82, footnote 67, (1842)), but I have not since been able to place it more exactly. It may be in the valley of the Rio Huallaga in the general neighborhood of Tingo Maria, or in that of the Pachitea tributary of the Rio Ucayali.

[22] None of the thirteen specimens of the species now before me have more than a few of the more proximal articles of the antennae remaining.

Tegmina with their apices surpassing those of the caudal femora by a distance subequal to the length of the pronotal disk, form relatively narrow, greatest breadth at apex of stridulating field contained six times in the tegminal length, costal and sutural margins in large part subparallel, nearly straight, the former rather abruptly arcuate to the rounded rectangulate apex, suturad of which a short section of the margin is arcuately oblique then broadly rounding into the sutural margin; proportions of fields and venation as in *Q. diaphana* except that the stridulating field is very slightly narrower and the stridulating vein is somewhat shorter and as a whole stouter. Wings surpassing the tegminal apices by a distance equal to slightly more than 1.3 times the length of the pronotal dorsum, costal margin of exposed section distad arcuate to the sutural rectangulate apex.

Meso- and metasterna with the lateral lobes very narrow, oblique, converging caudad, their free margins briefly arcuate latero-cephalad, nearly straight truncate thence distad, those of the mesosternum well separated caudad, of the metasternum contiguous caudad. Dorsum of abdomen medio-longitudinally sharply tectate proximad, this becoming subobsolete distad; ultimate tergite moderately transverse, its distal margin broadly bisarcuate produced between and dorsad of the cercal bases, the median section of the margin flattened to shallowly concave,[23] dorsal surface of ultimate tergite with three-fourths of its median length concavely impressed and deflexed ventro-distad to and involving the distal margin, which is there evenly depressed in between the cercal bases; supra-anal plate[24] roughly trigonal in outline, somewhat broader at its base than the median length, with the outline of the apex bluntly rounded, the surface shallowly and very narrowly lineate impressed medio-longitudinally; cerci elongate, slender, caliper-like, nearly four times as long as the medio-dorsal length of the ultimate tergite, as seen in profile the peduncle is subvertical, stout but narrowing ventrad to its junction with the shaft, its surface rather heavily studded with low rounded setigerous tubercles, shaft of cercus joining peduncle at a marked angle, in proximal two-thirds of its length subequal in depth and as seen in profile the dorsal and ventral margins are there subparallel, distal two-fifths directed slightly dorso-distad but of the same depth, distal margin oblique-subtruncate, dorso-distal spine short and straight, somewhat longer than the vertical depth of the distal extremity, surface of the whole distal two-fifths minutely rugulose, the distal margins also with a pronounced white fimbriation, as seen in dorso-mesal aspect the internal surface of the shaft of the cercus is strongly concave-excavate longitudinally to the distal margin, while the axes of the distal two-fifths are slightly inbent, ventral surface of shaft moderately deplanate except near apex, internal spinose production developed (as in the other species of the genus) from the more ventral of the internal borders of the shaft concavity at a point very close to the juncture with the subvertical peduncle, the base of the production trigonal in outline and depressed, with its distal spine slender and curving dorsad; subgenital plate with its median production relatively narrow, the length of the production subequal to that of the broader more proximal portion of the plate, the breadth of the production subequal to half its length, lateral margins of production as seen from venter shallowly concave and faintly diverging distad, the median fissation of the distal margin slit-like and very narrow, extending proximad for half the length of the production, the paired processes thus produced being obliquely truncate distad, and each bearing on its ventral extremity a minute nodose stylar structure.

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[23] The type shows the former condition, while the latter is seen in individuals of the paratypic series.

[24] In all the individuals of this species examined the supra-anal plate is retracted into the anal cavity so far that its exact form cannot be determined except in a single paratypic male from Tingo Maria. The features here given have been taken from this latter specimen.

Cephalic femora, as in all the species of the genus, shorter and much stouter than the median ones, appreciably compressed, their length subequal to that of the pronotal disk, ventral margins unspined; cephalic tibiae 1.3 times as long as the femora, slender distad of the tympanal expansion and weakly curving laterad. Median femora, as usual in *Quiva*, more elongate, more slender and less compressed than the cephalic ones, their length equal to 1.6 times that of the cephalic pair, as a whole subequal in depth, the carinate ventral (flexor) margins unspined, as seen from dorsum the proximal third is appreciably inbowed to the articulation; median tibiae somewhat longer than the femora (as 145 to 130), subcompressed, in profile gently tapering distad, the distal section as seen from dorsum slightly incurved, dorsal (extensor) surface subdeplanate proximad, dorsal (extensor) margins unspined, ventral (flexor) margins with well-spaced spines. Caudal femora moderately elongate, appreciably inflated in proximal half, very slender and rod-like in distal half, ventral surface shallowly, and distad very narrowly, sulcate, bounding margins cariniform, the external one distad with 1–2 small spines; caudal tibiae subequal to the femora in length.

Coloration.—The color pattern of *Q. pulchella* in its basic features is essentially the same as that of *Q. diaphana* as figured by Hebard.[25] The pattern on the head, pronotum, abdomen, limbs and genitalia is the same in character and distribution, while on the tegmina the dark blotches are larger, the smaller ones more fused into larger units and thus more strikingly contrasted (see pl. XVII, figs. 22 and 23). There is but little individual variation in the size and outline of the darker markings, such as is evident being solely of the pronotal and tegminal blotches. The pale base color is usually creamy-white, rarely dead white, and almost always on the pronotal dorsum it is tinted with flesh-color to a variable degree, while sometimes the vitreous hyaline tegmina are faintly tinted proximad with the same. The dark color is fuscous-black and always clearly and sharply contrasted with the base.

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[25] Trans. Amer. Entom. Soc., LII, pl. XVIII, fig. 1 and pl. XXII, fig. 1, (1927).

Measurements (in millimeters)

	Overall length	Length of body	Length of pro-notum	Length of tegmen	Greatest width of tegmen	Length of exposed portion of wings	Length of caudal femur
♂, Leonpampa, Peru *type*....	34	13.5	3.8	25	4.2	5.1	17.2
♂, Tingo Maria, Peru *paratype*.......	32	13.3	3.9	23.6	4.4	5.5	17.6
♂, Tingo Maria, Peru *paratype*	34.5	13	3.9	26	4.2	5.8	18.5

Paratypes.—In addition to the type I have before me twelve males from Tingo Maria, Rio Huallaga, Huanuco Department, Peru, elevation 670 meters, taken in January, 1942 (3), 1946 (2) and 1947 (5), and December, 1942 (2), by W. K. Weyrauch. All of these specimens, which are the property of the Academy and of the Museo "Javier Prado" of the University of San Marcos, Lima, Peru, I am considering paratypes.

Variation.—The preceding table of measurements, in which the dimensions of the extremes in the Tingo Maria series are given, show that except in the length of the alar organs and of the caudal femora there is little noteworthy size variation. The number of spines present distad on the ventro-external margin of the caudal femora varies individually from one to four. The extent of color variation has been discussed above.

Quiva abacata (Brunner)

1878. *H*[*ammatofera*] *abacata* Brunner, Monogr. der Phaneropt., p. 147. [♀; Brazil.]

SURINAM: Moengo, Boven Cottica River; V, 27, 1927; 1 ♂; [A.N.S.P.]. FRENCH GUIANA: Maroni; 1 ♂; [A.N.S.P.].

The sole previous publication we have on *abacata* is the brief, vague and generally unsatisfactory original description, and Hebard's comment,[26] when describing the present genus, that the species may be referable to *Quiva*. As I have never seen a female individual of this genus, all sixteen specimens now before me being males, it is possible to compare merely the limited number of ambisexual features mentioned by Brunner with the material before me. In consequence I am referring the two Guianan males above recorded to *abacata* provisionally, as the future may show Brazilian material represents a different species, in which case the Guianan one is undescribed. However, there is no outstanding feature of difference in the present material from Brunner's description. The features given in the preceding key to the species of *Quiva* will serve to distinguish *abacata,* as I understand it, from the other members of the genus now known. However, the following more detailed description of the male external genitalic features, taken from the Maroni specimen, may prove of service.

Ultimate abdominal tergite in greater part trapezoidally produced, this involving the entire distal portion between points dorsad of the middle of the cercal bases, the lateral margins of this area, as seen from the dorsum, obliquely straight convergent to the broad transversely subtruncate [27] section of the distal border, which in width is equal to approximately half that of the base of the trapezoidal structure, more lateral portions of the distal margin of the tergite very shallowly concave about the cercal bases, as seen in profile most of the median production is appreciably depressed disto-ventrad, while the dorsal surface of distal three-fourths of the tergite is appreciably concave transversely, with a subobsolete medio-longitudinal impression; supra-anal plate strongly retracted and exact shape not clearly ascertainable; cerci elongate, quite slender, caliper-like, about 3.25 times as long as the medio-dorsal length of the ultimate tergite, the passage from the stout peduncle to the shaft less angulate and more regularly arcuate than in *Q. pulchella* or *diaphana*, surface of peduncle studded with setigerous tubercles as in the other species, shaft tapering in depth in the proximal three-fifths as seen in profile, thence distad subequal in the same aspect, ventral margin in same view arcuate, this definitely weaker in proximal three-fifths, least depth at three-fifths of length, thence distad faintly deeper but with dorsal and ventral margins more nearly subparallel than proximad, the dorsal margin faintly serrulato-carinulate, distal two-fifths of shaft appreciably curving dorsad, distal extremity bluntly but rather narrowly rounded with a very short, blunt and little evident dentiform tubercle, which is largely buried in short white fimbriae, as seen from dorsum dorsal surface is similarly but more shallowly concave excavate longitudinally than in *Q. pulchella,* deplanation of ventral surface involving proximal half and more rounded distad, but with ventro-internal margin briefly and preapically serrulato-carinulate as is the dorsal margin, the immediate apex rounded in this aspect, internal spinose production less extended mesad than in the other species, its shorter and less aciculate spinose apex directed almost distad; subgenital plate much as in *pulchella* but as a whole proportionately shorter, median fissation somewhat deeper, involving more than half the length of the distal production, stylar nodes similar to but faintly larger and more evident than in *pulchella.*

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[26] Trans. Amer. Entom. Soc., LII, p. 277, (1927).

[27] This is virtually straight in the Maroni male, very slightly concave in that from Moengo, Surinam.

The two specimens before me show the following measurements (in millimeters), to which I have added Brunner's dimensions of the type.

	Length of body	Length of pronotum	Length of tegmen	Greatest breadth of tegmen	Length of caudal femur	Length of ovipositor
♂, Moengo, Surinam....	15.3	4.2	22.6	4.7[28]	18.5	—
♂, Maroni, French Guiana..	15.3	4.1	24.4	4.4[28]	18.4	—
♀, "Brazil," *type* (ex Brunner).....	14	3.2	22.5	3	17	5

The original locality has the vagueness shared by all species with "Brazil" as their source. The species may have come from Amazonian Brazil, but the majority of such "Brazil" records seem to be of other than purely Amazonian forms. However, the two records here given show the occurrence of the species at lowland Guianan localities of purely tropical character, with the limits of the range of the species outside of the Guianas at present unknown.

MACHIMOIDES[29] new genus

Readily distinguished from *Machima* by the subequal and brevispinose character of the genicular lobes of the cephalic and median femora, by the compressed and cultriform production of the vertex, and by the cerci of the male being much shorter, not elongate nor forcipate, and not compressed.

Generic characters.—Form elongate, slender, subcompressed. Vertex developed into a subcultriform compressed process, conical in profile, extending dorso-cephalad, at the latero-cephalic bases of which are placed the very large but low paired ocelli; paired infra-ocular linear callosities extending ventrolaterad to caudal bases of mandibles; eyes prominent, globose; antennae elongate, surpassing body in length, proximal article twice as long as second one. Pronotum sellate, disk with a pattern of callose lines, roughly a medio-longitudinal one, a broken pair in the usual position of lateral carinae, one bordering the caudal margin and a median V-shaped one delimiting the prozona and metazona, the two latter parts of subequal length on median line; lateral lobes of pronotum with humeral (tegminal) sinus rectangulate, remainder of caudal and ventral margins of lobes nearly (*vivasi* and *yuracare*) or quite (*minarum*) regularly and continuously arcuate. Tegmina surpassing apex of abdomen by much of their length in the ♂, but little longer in the ♀, narrow, the two margins subparallel in the proximal three-fourths, sutural margin angularly broadened very briefly proximad of apex, the distal (apical) section of outline obliquely concave, venation of tegmina etched into relief and moderately elevated, cross-nervures delimiting major areolae approximately as conspicuous as the principal longitudinal veins, areolae filled with a cribrose pattern of areolets, principal longitudinal veins and cross-nervures delimiting major areolae always (*vivasi*), and also sometimes many of the anastomosings forming the areolets as well (*minarum* and *yuracare*), similarly colored and contrasted. Wings with distal extremity surpassing apex of the closed tegmina by a distance at least equal to the length of pronotum, the actual apex of wings acute, venation of exposed portion of wings similar to that of tegmina. Prosternum unarmed and non-lobate; mesosternum and metasternum with arcuate lobations laterad. Ultimate abdominal tergite of male transverse, its distal margin moderately arcuate, its surface mesad subimpressed within bounding callose lineations; supra-anal plate of male with a lanceolate impressed median area delimited by similar lateral callose lines, laterad of which are present deflexed wings to the plate; cerci of male simple, cylindrical, somewhat tapering distad, short, with apex recurved and mucronate, a disto-median tooth present on internal face; subgenital plate of ♂ moderately produced meso-caudad, ventral surface of plate longitudinally tricarinate, distal margin angularly emarginate, styles short and articulate; ovipositor of ♀ no longer than cephalic femora, moderately falcate, apex rounded subacute, margins entire; subgenital plate of ♀ subtrigonal in outline, tectate in cross-section. Cephalic and median femora with genicular lobes brevispinose but not attenuately rod-like, caudal femora with both genicular lobes elongate and attenuately produced, rod-like; cephalic and median limbs slender, not distinctly compressed, their femora unarmed ventrad; caudal femora elongate, reaching almost as far caudad as the tegminal apices, ventro-cephalic (ventro-external) margin with elongate sublobate spines, ventro-caudal (ventro-internal) margin similarly armed (*yuracare*) or unarmed (*vivasi* and *minarum*); caudal tibiae with spination of the extensor margins elongate, compressed, much like that of ventro-cephalic margin of caudal femora.

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[28] In both of these cases the measurement is taken at the apex of the stridulating field.

[29] From *Machima* and εἶδος *form,* in allusion to its resemblance to the genus *Machima.*

GENOTYPE: *Machimoides vivasi* new species.

Distribution.—The genus is known to me from three rather widely separated areas, one in coastal Venezuela, another on the eastern slopes of the Andes of Bolivia, and the third in the interior of eastern Brazil. With this demonstrated range doubtless other representatives of the genus will be found more broadly over the non-alpine portions of tropical South America.*

Key to the Species of Machimoides (based on ♂ sex)

1. Caudal femora with ventro-internal (ventro-caudal) margin unarmed. Size larger (♂ overall length, 37.5–41 mm.). Alar organs longer, the tegmina appreciably surpassing the apices of the caudal femora, the wings surpassing the femora by a distance equal to more than twice the pronotal length 2

   Caudal femora with ventro-internal (ventro-caudal) margin armed similarly to the ventro-external (ventro-cephalic) one. Size smaller (♂ overall length, 26.5 mm.). Alar organs shorter, the tegmina failing to reach, and the wings but very slightly surpassing, the apices of the caudal femora. (Bolivia.) .... **yuracare** new species

2. Size larger (♂ overall length, 41 mm.). Limbs as a whole and pronotum proportionately longer, length of latter contained at least 1.6 times in that of cephalic femur, length of cephalic femur contained three times in that of caudal femur. Caudal margin of pronotal disk broadly arcuate, hardly indented mesad; lateral lobes of pronotum slightly longer than their depth ventrad of tegminal sinus. Tegminal areolation more finely cribrose. Subgenital plate of ♂ with interstylar distal margin acute-angulate emarginate. (Venezuela.) .... **vivasi** new species

   Size smaller (♂ overall length, 37.5 mm.). Limbs as a whole and pronotum proportionately shorter, length of latter contained less than 1.5 times in that of cephalic femur, length of cephalic femur contained 3.3 times in that of caudal femur. Caudal margin of pronotal disk as a whole more transverse and bisarcuate, appreciably indented mesad. Tegminal areolation more coarsely cribrose. Subgenital plate of ♂ with interstylar distal margin rectangulate emarginate. (Brazil.)
   minarum new species

Machimoides vivasi[80] new species

(Text-figs. 5 and 6; pl. XVII, figs. 24 and 25.)

As the preceding key emphasizes, this species is larger, with more elongate limbs and pronotum, more finely areolate tegmina and a more deeply divided distal margin to the male subgenital plate, when contrasted with *M. minarum*. In coloration the unique type has the pale vein lineations of the tegmina more pronounced than those of the similarly unique type of *M. minarum*, and the infuscate patches on the tegmina are smaller, but these features may prove to be purely individual.

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* We now know this genus clearly reaches Mesopotamian Argentina. In a paper not available when this manuscript was prepared Pirán (Acta Zool. Lilloana, II, pp. 5–7, plate, (1944)) has recorded, described and figured a species of this genus from Itatí, Corrientes, Argentina, as *Machima phyllacantha* (Burmeister). It is not Burmeister's species, it is a *Machimoides*, and is distinct from any now in hand. It combines certain features of *vivasi* and *minarum*, but on the basis of the above cited description and figure is well separated from both. On the evidence of Pirán's information I here apply the name *Machimoides pirani* to it.

[80] In honor of my friend Señor Gaston Vivas y Berthier, who collected the type.

Type.—♂; San Esteban, Carobobo, Venezuela.[31] September 25–29, 1937. (Gaston Vivas y Berthier.) [Academy of Natural Sciences of Philadelphia, Type no. 5755.]

Size medium (overall length, 41 mm.).

Head with infra-ocular callose lines well elevated, oblique, nearly straight, infra-ocular section of antennal scrobes elevated and cingulate; angle of fastigium of face rounded acute, well separated from the low and non-projecting fastigium of vertex, the dorsal surface of which is briefly sulcate, then smoothly passing into the cephalic face of the dorso-cephalad directed production of the vertex, which latter regularly narrows distad, as seen in profile, with its dorsal point acute but not spiniform, as seen from the dorsum the process is subconical with its distal third very distinctly compressed, the length of the process distad of the eyes, as seen in profile, being but slightly less than the eye depth (as 26 to 30); eyes quite prominent. Antennae incomplete but doubtless surpassing the tegminal apices when entire, more proximal articles distad of second slightly thickened at their distal extremities.

Pronotum with its general sellation quite pronounced, the prozona appreciably concave when contrasted with the metazona, which is more elevated and then deplanate dorsad, and to a lesser degree vertically flattened on the lateral lobes dorsad, greatest breadth across dorsum of metazona equal to approximately seven-eighths of the total medio-dorsal pronotal length (as 71 to 83); cephalic margin of disk moderately concave, caudal margin of same broadly and regularly arcuate, obsoletely indented mesad, apart from the pattern of callose lines there is present cephalad on the metazona a transverse rounded swollen elevation, this weakly concave in pattern as seen from the dorsum, and with its border dropping sharply to the pronotal level on the cephalic side, while caudad the boundary between it and the metazonal surface is similarly but much less sharply defined, this structure becoming obsolete dorsad on the lateral lobes; pattern of contrasted callose lines on pronotal dorsum consisting of a medio-longitudinal one which is narrowly broadened at the cephalic border of the transverse swell, which it crosses, paired lateral ones in the usual position of pronotal lateral carinae when these are present, and a narrow but equally distinct edging to the caudal periphery of the disk, on the lateral lobes these lines form a full cingulate border of the lobe except for a brief immediately postocular section, and in addition an incomplete infra-median sinuate line which extends from the marginal callosity at its dorsal postocular end caudad for slightly more than half the lobar length, while less definite is a vertical callosity connecting the last-mentioned incomplete line and that bordering the disk laterad, and following the transverse sulcus on its cephalic side, transverse sulcus of pronotum deeply V-impressed dorsad and on dorsal portion of lateral lobes, not severing lateral callose lines of disk; general outline of lateral lobes with greatest length slightly greater than median depth from dorsal line of pronotum (as 22 to 20), margins semicircular except for a slight flattening in two planes ventro-cephalad, tegminal sinus rounded rectangulate.

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[31] San Esteban is five miles south of Puerto Cabello. Elevation approximately 40 meters.

Tegmina surpassing the apices of the caudal femora by a distance nearly equal to the dorsal length of the pronotum, narrow, subequal in width except for the characteristic preapical expansion of the sutural margin, the average breadth proximad of the expanded portion not quite equal to one-sixth of the tegminal length (as 30 to 198), sutural margin expansion at broadest point, which is proximad of the tegminal apex a distance equal to but half the length of the pronotum, equal to slightly less than one-fifth of the tegminal length, costal and sutural margins approximately parallel distad to the sutural margin expansion, to the acute apex of which latter for some distance the sutural margin concavely ascends, distal extremity of tegmen sharply oblique concave to the apex, which is costad and rounded rectangulate; marginal field moderately broad in proximal two-fifths of tegminal length, stridulating field with its breadth subequal to that of metazona of pronotal disk; humeral trunk slightly sinuate in proximal half. median and ulnar veins connected by an oblique transverse nervure, anastomosing cribrose pattern of the areolae slightly more intricate than in *M. minarum,* main ramus of median vein reaching to the apex of the sutural expansion of the tegmen. Wings with their apices surpassing those of tegmina by a distance equal to the length of the cephalic femora, this portion narrow, with its apex sutural in position and sharply acute, the costal margin well arcuate to the apex from the subequal width of the proximal half of the normally exposed section, texture and venation of the exposed section of wings as in the tegmina.

Prosternum strongly V-shaped, with slender diverging arms extending latero-cephalad along the internal face of the cephalic coxae, from a narrower, more caudal medio-central section; mesosternum with cephalic margin concave, lateral ones converging caudad to the narrow caudal extremity, the lateral sections suberect and narrowly arcuato-sublamellate; metasternum with its general form much as mesosternum but cephalic margin rounded obtuse-angulate and caudal extremity more attenuately prolonged and sharply and narrowly fissate, lateral sublamellate borders much as those of mesosternum but not quite reaching the caudal points of the metasternum. Pleura with several subvertical callose lines. Abdomen moderately compressed dorsad; each tergite, and less completely each sternite, margined distad by an elevated callose line, while the lateral surfaces of the terga bear a series of three similar longitudinal lines, broken up by the distal borderings of the same.

Ultimate tergite with its proximal breadth equal to approximately three times its median length, median section of distal margin shallowly emarginate between a pair of raised callose lines, which reach proximad to the base of the tergite, are transversely connected by a similar arcuate callose line, and thus enclose a depressed median area involving two-thirds the length of the tergite, the paired lines swinging arcuately laterad as marginal borders to the tergal lateral bases, thus sinuately outlining dorsad the cercal bases; supra-anal plate with a median semi-lanceolate central section, subequal to the greatest length of the ultimate tergite, this area subacute at apex and shallowly impressed within its callose margins, lateral portions of supra-anal plate obliquely declivent, longer than wide, narrowing distad, and with their dorsal surfaces facing the internal sections of the cerci; cerci not quite twice as long as supra-anal plate, subcylindrical, relatively stout in proximal half, tapering distad, apices bluntly recurved mesad and briefly mucronate, internal face at distal three-fifths of length with a slender, moderately recurved non-spinose lobiform tooth; subgenital plate narrowing distad, its breadth there equal to approximately half that at base, distal margin deeply acute-angulate emarginate, prestylar pair of ventral carinae elevated callose ridges, medio-ventral carina a low but rather sharp angulate ridge, styles relatively stout, rounded distad, in length slightly shorter than interspace between the stylar bases.

Cephalic femora slender, in length equal to 1.6 times that of pronotum, slightly arcuate dorsad as seen in profile, subequal in depth, faintly subcompressed, genicular lobes spiniform, the internal (cephalic) somewhat longer than the external (caudal),[82] ventral surface with weak unspined marginal carinulae; cephalic tibiae slightly more than 1.25 times the femoral length (as 47 to 60), no juxta-tympanal spines present, slender disto-tympanal portion with 2–4 spaced spines on the external (caudal) margin, dorsal surface shallowly sulcate. Median femora slightly more than 1.5 times as long as the cephalic femora (as 70 to 45), similar in general form to the latter, but faintly arcuate only proximad, genicular lobes with the spinations subequal in length, external (cephalic) one accompanied ventrad by a much smaller marginal spinule, ventral margins unarmed; median tibiae nearly 1.3 times as long as the femora (as 89 to 69), dorsal margins with 0–2 (cephalic or external) or 5–7 (caudal or internal) spines, dorsal surface subsulcate, proximal portion of tibiae weakly compressed. Caudal femora with length appreciably surpassing that of body, their apices reaching distad approximately as far as the dilation of the sutural margin of the tegmina, form slender, attenuate, both genicular lobes attenuately produced, rod-like, subequal in length, ventro-external (ventro-cephalic) margin with six spaced, compressed proximally sublobiform spines in distal two-thirds, the proximal one smaller than the others, all directed disto-ventrad and in outline acutely subcultriform with the apex very faintly recurved, ventro-internal (ventro-caudal) margin unarmed, ventral surface sulcate; caudal tibiae 1.25 times as long as the femora (as 185 to 147), slender, both extensor margins multispinose, proximad these spines are larger, subcompressed and resembling those of the ventro-external margin of the femora, regularly decreasing distad in length and size, those near distal extremity not greatly larger than the delicate and more widely spaced spinules found on distal half of both flexor margins.

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[82] The former is accompanied on one side ventrad by a minute second spinule in the unique type.

Coloration.—Base color of body (i.e., head, pronotum, sterna, pleura and abdomen) ranging from as pale as light dull green-yellow (of Ridgway) to courge green, the former on the face and genae, the latter on the abdomen, the whole with its overlaid pattern of numerous callose elevated lines outlined in cream color, the latter on the sides of the abdomen, and less fully on the pleura, largely relieved by bordering pencillings of bister to fuscous, dorsum of occiput and pronotum courge green, the former with longitudinal continuations of the median and lateral cream lines which are so pronounced on the pronotum, the disk of the latter with the margins of the cream colored callose lines in considerable part outlined in fuscous, the surface of the two discal areas of the metazona also thickly stippled with the same; tegmina and normally exposed portion of the wings courge green to oil green, the principal veins and cross-nervures which outline areas cream color to sulphur yellow, a number of the areas in part scumbled or sprinkled with fuscous, which fills the areolets but leaves the minor anastomosing veinlets of the base color; limbs with base color ranging from sulphur yellow to light lumiere green, the femora with dorsal face, and to a lesser degree the external or cephalic, with three oblique maculae of fuscous to mummy brown, those on the caudal and the distal one on the median femora roughly chevron-shaped, ventral surface of caudal femora with three maculae of fuscous, distal margin of spines of same and of the more proximal ones on the caudal tibiae bordered in their proximal two-thirds or so with fuscous. Antennae with widely spaced dark annuli. Eyes buckthorn brown.

Measurements.—Overall length, 41 mm.; length of body, 20.2; length of pronotum, 4.4; length of tegmen, 32.2; greatest breadth of tegmen at distal expansion, 5.8; length of wings distad of tegminal apices, 7.3; length of cephalic femur, 7.3; length of caudal femur, 23.9.

The type of this striking species is unique.

Machimoides minarum[88] new species
(Text-figs. 7 and 8; pl. XVII, figs. 26 and 27.)

The chief features distinguishing *minarum* from the genotypic *vivasi* have been pointed out in the preceding key to the species of the genus. In addition the sublobate spines of the caudal limbs are relatively shorter and broader at their bases than is true of *vivasi*, in which they are more elongate and relatively narrower on both the femora and tibiae.

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[88] *Of the mines*, in allusion to the State of Minas Gerais, whence came the type.

Type.—♂; Lassance, Minas Gerais, Brazil.[34] November 9–19, 1919. (Cornell University Expedition.) [Academy of Natural Sciences of Philadelphia, Type no. 5756.]

Size appreciably smaller than in *M. vivasi* (overall length, 37.5 mm.).

Head with infra-ocular callose lines and infra-ocular portion of the antennal scrobes as in *vivasi*; angle of fastigium of face and development of vertex as in *vivasi*, except that the apex of the low fastigium of the vertex is appreciably more evident and nodose, and the subcultriform process of the vertex is slightly narrower at base as seen from dorsum and in profile it is somewhat longer, distad of the eyes being subequal to the depth of the latter, and more evenly acuminate distad in the same view; eyes more prominent than in *vivasi*. Antennae slightly surpassing the tegminal apices, the distal thickening of certain proximal articles mentioned in the description of *vivasi* less distinctly evident.

Pronotum slightly shorter and broader proportionately than in *vivasi*, not as pronouncedly sellate as in the latter, in profile the dorsal line of the prozona is more nearly parallel to that of the metazonal section and with less distinct concavity, greatest breadth across metazona equal to but slightly less than nine-tenths of the total medio-dorsal pronotal length (as 65 to 74); cephalic margin of disk much more shallowly concave than in *vivasi*, caudal margin of same not forming a single broad arcuation as in *vivasi*, instead made up of a pair of shorter separate arcuations separated by an appreciable median indentation, caudo-lateral sections of caudal margin more narrowly arcuate than in *vivasi*, in which latter they are undifferentiated from the broad sweep of the whole of the caudal margin; general pattern of elevated or subelevated callose lines or ridges on dorsum of pronotum essentially the same as in *vivasi*, but the internal borders of those touching the metazonal disk cephalad and caudad are more irregular and in places lobulately intrusive on the smoother disk surface, while the post-sulcal transverse elevation is broader (longitudinally) but lower than in *vivasi*, less sharply marked off from the metazonal disk caudad; on the lateral lobes the callose lineate pattern is much more broadly thickened than in *vivasi*, while the infra-median line extends completely across the lobes, and the postmedian section dorsad has some irregular, in general subvertical, sinuate rugulae or carinulae of varying length, one of which ends dorsad at the humeral sinus; transverse sulci of pronotum as in *vivasi* but as a whole not as deeply impressed; general outline of lateral lobes with length and depth from dorsal line of pronotum subequal, margins virtually as in *vivasi* except that the tegminal (humeral) sinus is slightly more sharply angulate impressed.

Tegmina with their general character very much as in *vivasi* except that they, like the limbs, are less elongate, apices surpassing those of caudal femora by a distance very slightly greater than the length of the pronotal dorsum (as 22 to 20), the position and character of the preapical expansion of the sutural margin as in *vivasi,* average breadth, except for the preapical expansion, contained 6.4 times in the tegminal length (as 25 to 160), slightly broader at proximal third, the breadth of the preapical expansion of the sutural margin equal to approximately one-sixth the tegminal length (as 30 to 160), shape of distal (apical) margin and apex as in *vivasi;* stridulating field slightly narrower than in *vivasi,* the angulation at sutural extremity of the stridulating vein somewhat more rounded and blunter than in *vivasi,* the breadth of the whole field slightly less than that of the pronotal metazona but venation of field as in *vivasi;* ulnar and median veins with the connecting ramus of such character that its true relationship (i.e., ulnar or median) is open to question, main ramus of median vein, as in *vivasi,* reaching to the apex of the sutural expansion, anastomosing cribrose areolet pattern more open and less dense than in *vivasi.* Wings surpassing apices of tegmina by a distance equal to 1.35 times the length of the cephalic femora (as 47 to 35), this area in form as in *vivasi,* its venation and texture as in the tegmina.

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[34] This locality is on the railroad between Curvello and Pirapora, about six miles west of the Rio das Velhas tributary of the Rio São Francisco. Approximate position, 44° 38′ W., 17° 53′ S.; approximate elevation, 500 meters.

Prosternum with its general structural pattern as in *vivasi,* but the diverging arms are more arcuate latero-cephalad and more widely separated at the bases; mesosternum with the lateral lobations more strongly arcuate at their periphery; metasternum with peripheral margin of the lobes appreciably more flattened and less arcuate than in *vivasi;* pleura and lateral abdominal surfaces with a pattern of callose lines in general similar to what is seen in *M. vivasi,* but the longitudinal elements on the sides of the abdomen are more triangularly enlarged and expanded where they join the distal marginal ones; ultimate tergite as in *vivasi* except that the median area lacks a proximal transverse callose line connecting the lateral pair, and the free distal margin of this area is transversely straighter; supra-anal plate as in *vivasi* except that its central portion is more elongate; cerci as in *vivasi;* subgenital plate as in *vivasi* except that the distal margin is rectangularly emarginate and the styles are more slender but no longer.

Limbs as a whole less attenuate than in *M. vivasi,* but general proportions in relation to other parts of the body very similar. Cephalic femora equal in length to 1.6 times that of the pronotal dorsum but appreciably less slender than in *vivasi,* genicular lobes similarly developed, ventral carinae somewhat more evident; cephalic tibiae nearly 1.4 times as long as the femora, a single juxta-tympanal spine placed distad of tympanum on dorso-external (dorso-caudal) margin, followed by 3–4 well spaced ones distad on the same margin, dorsal surface shallowly sulcate. Median femora slightly more than 1.6 times as long as the cephalic femora (as 54 to 33), as with the latter slightly more robust than in *M. vivasi,* straight in lateral aspect, slightly arcuate proximad as seen from dorsum, genicular lobes developed as in *vivasi* but with external (cephalic) one slightly the longer, ventral carinae unspined; median tibiae 1.35 times as long as the femora (as 73 to 54), dorso-cephalic (dorso-external) margin unarmed except distad, the dorso-caudal (dorso-external) one with four spaced spines, dorsal surface sulcate and proximal portion of tibiae weakly compressed as in *vivasi*. Caudal femora with their proportionate length and development as in *vivasi*, also the development of the genicular lobes, ventro-external (ventro-cephalic) margin with the spaced and compressed proximally sublobiform spines 5 to 6 in number, the proximal one smaller than the others, all proportionately broader at the base than those of *vivasi*, their general outline more evenly trigonal than those of the latter, the apices similarly slightly recurved, ventro-internal (ventro-caudal) margin of femora unarmed, ventral surface sulcate, subobsoletely so distad; caudal tibiae with proportions, character and spination as in *vivasi*.

Coloration.—Pattern almost a replica of that of *M. vivasi* except that the dark stippled areas of areolet involvement on the tegmina and exposed portion of wings are individually more extensive and apparently, but not actually, fewer, the latter condition being due to the lesser evidence of the principal cross-nervures, which do not break the darker areas into subdivisions as obviously as in *vivasi*, also the darker maculae on the dorsal surfaces of the cephalic and median femora are less strongly oblique, less evenly spaced and more blotched and irregular, particularly in their rather heavy invasion of the cephalic (internal) face of the cephalic femora. The pale base color is more generally light dull green-yellow than in *vivasi*, becoming very weakly cosse green (of Ridgway) on the tibiae; dark shade of the dorsal half of the lateral lobes of the pronotum, and obscurely the base tone of the pronotal disk aside from the darker infuscations and cream-colored callose linings, as well as a faint tendency in the occipital base color, pale ecru-olive. Antennae with a number of well-spaced rather broad olive annuli; eyes tawny-olive.

Measurements.—Overall length, 37.5 mm.; length of body, 17.6; length of pronotum, 3.5; length of tegmen, 26; greatest breadth of tegmen at distal expansion, 4; length of cephalic femur, 7.3; length of caudal femur, 19.2.

The type is unique.

Machimoides yuracare[85] new species

(Text-figs. 9-11; pl. XVIII, figs. 28-31.)

This striking species suggests a transition to the genus *Machima* in the heavily spined ventro-internal margins of the caudal femora, but the structure of the fastigium, pronotal details, femoral genicular spine proportions and the tegminal venational pattern all show its predominating *Machimoides* relationship. In certain respects the species is nearer *Machimoides vivasi* than *minarum*, but in addition to the characters given in the key to species of the genus, it can also be separated from both the others by the stouter internal tooth of the male cercus and the rather shorter limbs.

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[85] After the aboriginal Yuracaré people of the general area where the species occurs.

Type.—♂; Songo, Bolivia.[36] [Vienna Natural History Museum.]

Size relatively small (overall length, 26.5 mm.); form less elongate than in the other species, alar organs much less elongate, limbs slightly shorter proportionately.

Head with its general form and pattern of callose lines as described for *M. vivasi;* fastigium of face with its angle slightly blunter and broader than in *vivasi;* production of the vertex more compressed, not as deep longitudinally and with its apex more acuminate and slightly more curved cephalad than in *vivasi,* the length of the production dorso-distad of the eyes being slightly less than the eye depth (as 28 to 25); eyes even more prominent and slightly more exserted than in *vivasi.* Antennae incomplete but slightly surpassing the alar apices, otherwise as in *vivasi.*

Pronotum with its general proportion essentially as in *minarum,* somewhat shorter and broader than in *vivasi,* although the general character of its sellation and the outline of the lateral lobes are more as in the latter, greatest breadth across dorsum of metazona equal to nine-tenths of the total medio-dorsal pronotal length; cephalic margin of disk obsoletely concave, caudal margin of same broadly and regularly arcuate but less strongly so than in *vivasi,* hardly indented mesad; transverse post-median swelling of dorsum and pattern of callose lines as in *vivasi* except that the medio-longitudinal line is narrower and more finely drawn, and the infra-median sinuate line on the lateral lobes is complete and continued to the caudal margin of the lobes; lateral lobes with greatest length equal to 1.2 times the median depth from dorsal line of pronotum (as 61 to 51), margins as in *vivasi* except for a slightly more evident oblique flattening of the caudal margin ventrad of the tegminal sinus.

Tegmina very narrowly failing to reach the apices of the caudal femora, proportionately shorter and broader than in the other species of the genus, the greatest depth as viewed in profile (ventrad of apex of stridulating field) contained not quite five times in the tegminal length (as 25 to 120), the general tegminal outline as viewed in profile, however, being the same as in the other species, the sutural apex of the preapical expanded portion, which is even more distad and hence more nearly approximates the tegminal apex than in the other species, is more sharply acute than in the relatives, and the breadth across the distal expansion is slightly less than one-fifth of the tegminal length (as 25 to 120) and subequal to the profile depth of the tegmen at the apex of the stridulating field, general outline of the tegmina and shape of the margins essentially as in *vivasi* except as qualified above and for the more nearly vertical and more strongly concave section between the tegminal apex and that of the distal expansion of the sutural margin; stridulating field as in *vivasi* but minor areolation somewhat coarser, areolation of marginal and discoidal fields as a whole slightly coarser than in either *vivasi* or *minarum*, in proximal half no coarser than in the latter species, but distad the areolar pattern is equally sized, while in *minarum* it is finer in that portion. Wings with their exposed section as in the related species, but surpassing the tegminal apices by appreciably less than the length of the cephalic femora.

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[36] Songo (or Zongo), is in northwestern Bolivia, in the Yungas district, at an elevation of 2050 feet. It is situated about 28 miles due north of La Paz, on the Zongo River, which flows into the Rio Coroico, this into the Rio Kaka, the latter in turn into the great Madeiran tributary the Rio Beni.

Prosternum as in *vivasi;* mesosternum as in *vivasi* but slightly more transverse; metasternum slightly more transverse and with the outline of the lobes fuller and more regularly arcuate. Pleura with their subvertical callose lines essentially as in *vivasi.* Abdomen with its general character and the pattern of its callose lines as in *vivasi.* Ultimate tergite much as in *vivasi* except that the paired arcuations of the distal margin are less prominent, the callose lining of the distal margin and that laterad of the median impression is finer and more delicate, the median impression is shallower in depth and more transverse, and proximad it is not definitely delimited by a transverse callose line but instead by a slight surface angulation; supra-anal plate with its central section more elongate and narrowly linguiform than in *vivasi,* its length subequal to twice the median length of the ultimate tergite and twice its own breadth, its surface similarly excavate, margins callose, apex moderately acute, lateral portions of supra-anal plate subvertically deflexed[37] and tucked under the median section and against the internal side of the cercal bases; cerci slightly more slender and tapering in the form of the shaft for a distance proximad of the distal hook, the latter curving meso-dorsad more appreciably than in *vivasi,* the apical claw sharper, internal tooth of shaft a relatively stout acute and recurved hooked process, its base subdeplanate dorsad, the whole much more robust than the fragile and slender polliciform rod of either *vivasi* or *minarum;* subgenital plate somewhat stouter and less attenuate than in *vivasi,*[38] carinations of ventral surface as in *vivasi,* while in profile the dorsal outline of the lateral sections is more strongly concave where rising proximad to the base, emargination of distal margin as deep as in *vivasi* but more narrowly fissate, its sides approximately subparallel, styles very short, little more than rounded, but articulate, nodes.

Cephalic and median limbs in general development and length essentially as in *M. minarum,* slightly less elongate than in *M. vivasi;* cephalic femora with their length equal to 1.63 times that of pronotum, genicular spines well developed and of equal length; cephalic tibiae 1.33 times as long as the femora, dorso-external (dorso-caudal) margins with a distinct juxta-tympanal spine and 4 spaced disto-tympanal ones. Median femora 1.4 times as long as the cephalic femora (50 to 36), genicular spines well marked and of subequal length, external one accompanied ventrad by a minute submarginal spinule, ventral margins unarmed; median tibiae 1.24 times as long as the femora (62 to 50), dorsal margins with 3 [89] (cephalic or external) or 8 (caudal or internal) spines. Caudal femora with length somewhat surpassing that of body, their apices very slightly exceeding those of the tegmina, general outline as in *vivasi*, genicular spines marked and subequal in length, ventro-external (ventro-cephalic) margin with 5–7 spaced proximally compressed sublobiform spines, the proximal one or two smaller than the others, ventro-internal (ventro-caudal) margin with 4 similar sized and formed spines in distal five-eighths of its length, ventral surface sulcate; caudal tibiae virtually 1.3 times as long as the femora (as 145 to 112), armed as in *vivasi*.

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[37] The exact character of these areas cannot be determined from the sole male available, as in the type the whole plate is pulled in between the cerci.

[38] In the type, which is the sole male of the species available, the subgenital plate has been somewhat compressed by pressure, and its relative breadth to length cannot be measured accurately. Similarly the exact degree of angulation of the distal emargination cannot be determined, yet it is evident this normally is more narrowly cut and more fissate than in *vivasi.*

Allotype.—♀; same data as the type. [Vienna Natural History Museum.]

Differing from the above description of the male sex in the following noteworthy respects.

Size somewhat larger (overall length 31.2 mm.), general build more robust, particularly of abdomen.

Pronotum in general as in male but greatest breadth across dorsum of metazona equal to four-fifths of the total medio-dorsal pronotal length; cephalic margin of disk very slightly more concave than in male, but not at all markedly so, caudal margin of same somewhat more strongly arcuate than in male, not indented mesad; lateral lobes slightly deeper in proportion, the greatest length equal to but 1.14 times the median depth from dorsal line of pronotum (as 65 to 57), margin broadly and almost uniformly arcuate from the postocular section of the cephalic margin to the humeral sinus.

Tegmina failing to reach the apices of the caudal femora by a distance equal to slightly more than the pronotal length, somewhat narrower than in the male sex, the greatest depth, as viewed in profile, contained nearly 6.2 times in the tegminal length (as 21 to 130), the general outline as in the male except that the sutural margin and the subtruncate apical margin are slightly less markedly concave, and the width of the distal expansion is contained nearly 6.2 times in the tegminal length, the former remaining equal to the more proximal tegminal depth, as in the male; venation and areolation as in the male, but the latter is slightly denser, finer and more intricate. Wings surpassing the tegminal apices by not more than two-thirds the length of the cephalic femora.

Abdomen with its callose pattern essentially as in the male sex; supra-anal plate and cerci damaged; ovipositor equal in length to four-fifths of the length of the cephalic femora, relatively slender, moderately arcuate, more distinctly so in proximal half than distad, and there weakly tapering, apices of dorsal valves slightly surpassing those of ventral valves, the former narrowly rounded, the latter definitely acute, margins smooth except that both the dorsal and ventral ones are minutely serrulate for a short distance proximad of the apices;[40] subgenital plate subtrigonal in outline with the apex broadly rounded, V-shaped in transverse section, the medio-ventral carina well marked but rounded transversely, not sharply carinate, lateral areas of ventral surface appreciably concave.

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[89] One median tibia is missing.

Limbs essentially as in the male in general form and basic proportions; median tibiae with dorsal margins having 0 to 1 cephalic or 6 to 7 caudal spines; caudal femora surpassing the apices of the abdomen and of the tegmina, and reaching to those of the wings, ventro-external margin with 8 spines similat to those of the male,[41] the proximal three smaller than those more distad, ventro-internal margin with 5 spines of similar character to those described for the male; caudal tibiae as in male type.

Coloration.—Pattern basically as in the other species of the genus, but somewhat more closely approximating that of *M. vivasi* in that the dark stippled areas of areolet involvement on the tegmina and exposed portion of wings are smaller, more broken up into smaller units and even as a whole darker than in *vivasi,* the major venational contrast as in that species. The darker maculae on the dorsal surfaces of the cephalic and median femora are as strongly oblique as in *vivasi*, and are no more intrusively evident on the cephalic face of the cephalic femora than in *vivasi*. The pale base color of the body ranges from straw yellow (male type) to light dull green-yellow (female allotype); of the limbs it is colonial buff (male) to primrose yellow (female). Dark maculae of head and pronotum strongly marked in sayal brown to saccardo's umber, the lateral aspects of the fastigial process strongly dark lineate. Antennae with well spaced dark annuli.

Measurements.—♂ (type), overall length, 26.5 mm.; length of body, 17.9; length of pronotum, 3.5; length of tegmen, 20.2; greatest breadth of tegmen at distal expansion, 4; length of wing distad of tegmina, 4; length of cephalic femur, 5.8; length of caudal femur, 19.2: ♀ (allotype), overall length, 31.2; length of body, 23.1; length of pronotum, 3.5; length of tegmen, 21.1; greatest breadth of tegmen at distal expansion, 3.5; length of wing distad of tegmina, 3.9; length of cephalic femur, 6.5; length of caudal femur, 20; length of ovipositor, 5.7.

Remarks.—The type and allotype are all the material which has been examined.

MACHIMA Brunner

1878. *Machima* Brunner, Monogr. der Phaneropteriden, pp. 19, 149.

The genus *Machima* is a very distinctive one, but its three recognizable species are closely related, have similar general facies, and are separable chiefly by details of the male external genitalia. In it we find a combination of a sellate, non-spined, pronotum, the metazona of which bears a marked cruciform pattern of raised lines, a moderately developed but non-cultriform production of the vertex, an absence of massed minute areolets in the areolae of the tegminal venation, the production of both genicular lobes of the caudal femora, but with the cephalic one only of the cephalic (there the internal) and median (there the external) femora so developed, and with both central margins of the caudal femora having large subfalcate and apically acute but proximally compressed and broadened spines. While in some respects *Machima* is nearer *Apolinaria* and *Markia* than it is to *Machimoides*, in others it is distinctly nearer the latter.

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[40] This armament is evident only under a magnification of at least × 20.

[41] But one caudal limb remains on the allotype.

Generic characters.—General features as in *Machimoides* here described except for the following obvious differences. Vertex with a dorsal nodose production which is much shorter than the length of the proximal antennal article, not developed into a subcultriform process as in *Machimoides*, face virtually lacking complete infra-ocular linear callosities, such as are present being disconnected remnants. Pronotum with general sellation and callose linear pattern as in *Machimoides*, the latter feature, however, radiating caudad from a point on the metazonal disk which is slightly premedian, and less evident cephalad of that point than in *Machimoides*, transverse low swelling on the disk longitudinally more broadly marked than in *Machimoides*, caudal margin of pronotal disk broadly and evenly arcuate; lateral lobes of pronotum with their length less than their depth from humeral (tegminal) sinus. Tegmina and exposed portion of wings of same general form as in *Machimoides*, with similar marked distal expansion of the sutural margin of the tegmina, areolation much more open and coarser, without the finely cribrose secondary pattern of areolets found in *Machimoides*. Prosternum, mesosternum and metasternum as in *Machimoides*. Abdomen with tergites, except distal two, having a median compressed lobulate acute and dorso-distad directed point on the caudal margin of each; ultimate abdominal tergite strongly transverse, simple; supra-anal plate trigonal in outline; cerci elongate, forcipate, compressed, apex elongate or abruptly acuminate, internal surface ventro-proximad with a mesad directed subfalciform process;[42] subgenital plate moderately produced mesad, interstylar margin angulately emarginate, styles short and articulate. Limbs moderately elongate, not as attenuate as in *Machimoides*; cephalic and median femora with cephalic genicular spine markedly elongate, in each sharply contrasted with the very abbreviate and little evident caudal one, caudal femora with both genicular lobes elongate produced, more regularly acuminate and less rod-like than in *Machimoides*; cephalic and median limbs moderately compressed, femora with at most but

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[42] It is not stated in previous descriptions whether this is present in *M. phyllacantha*, but it presumably is, as the structure is strongly marked in the two species of the genus now before me.

1–2 spaced spines ventro-distad on the cephalic margin; caudal femora failing to reach tegminal apices by a distance at least equal to the pronotal length, both ventral margins armed with elongate sublobate spines; caudal tibiae with spination of the extensor margins proximad very similar in character to that of the ventral margins of the caudal femora but regularly decreasing in size and length distad, the longer ones more falcate in outline than in *Machimoides*.

GENOTYPE (by selection of Kirby, 1906).—*Phaneroptera phyllacantha* Burmeister [= *Machima phyllacantha* (Burmeister)].

Key to Species of Machima

1. Male cerci elongate, upcurved, not in greater part of uniform depth, evenly acuminate in distal portion to the aciculate apices. (Internal process of cerci ?)........................ **phyllacantha** (Burmeister)

Male cerci elongate, but not upcurved, of uniform depth in greater proximal portion and sharply and briefly acuminate at apices. (Cerci at proximo-internal base with a pronounced mesad-directed spinigerous process.)..2

2. Process of vertex more evident, breviconical. Male cerci shorter, as a whole somewhat deeper, as viewed from venter the cercal axis is moderately sigmoid and not strongly falcate distad, ventro-internal margin of cercus with several spaced nodes................ **scalprum** new species

Process of vertex less evident, relatively low, subcompressed, rectangulate in profile. Male cerci longer, as a whole shallower, as viewed from venter the cercal axis is hardly sigmoid, while the distal two-fifths of the length is sharply and falcately inbowed, ventro-internal margin of cercus without spaced nodes......................... **paranensis** new species

Distribution.—Eastern and southeastern Brazil (states of Bahia, Paraná and Santa Catarina).

Machima phyllacantha (Burmeister)

1838. *Ph[aneroptera] phyllacantha* Burmeister, Handb. der Entom., II, abt. II, pt. 1, p. 688. [♂; Bahia[,Brazil].]

1878. *M[achima] phyllacantha* Brunner, Monogr. der Phaneropt., p. 149, tab. III, fig. 39a.

I have seen no representative of this species, of which Brunner had Burmeister's material before him. The features I have given in the preceding key to distinguish it from the new species here described have been drawn from the descriptions of Burmeister and Brunner, and the figure given by the latter. The only exact locality from which the species is known is Bahia.*

I am unable to say with any more certainty than Brunner could

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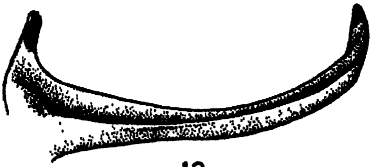
* See footnote under the genus *Machimoides* relative to Pirán's incorrect association of this species with an Argentine species of *Machimoides*.



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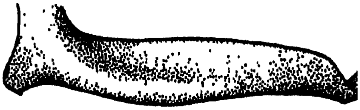

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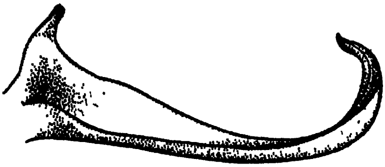

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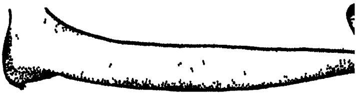

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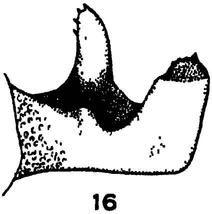

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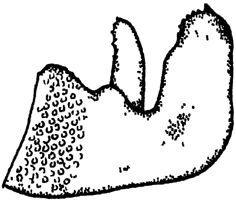

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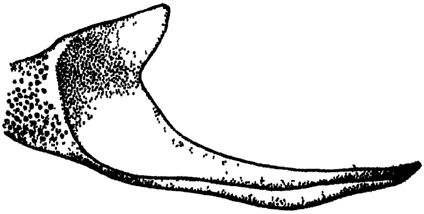

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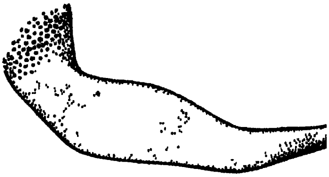

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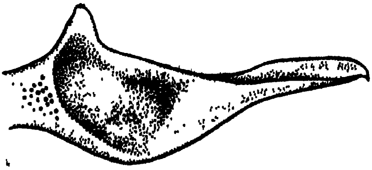

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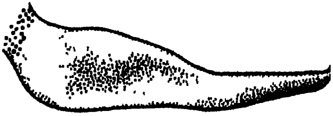

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in 1878 whether Serville's *Phaneroptera acanthocephala,*[43] described from "New Holland," was erroneously labelled for locality and is a member of the genus *Machima,* and if so whether it is identical with Burmeister's *phyllacantha,* although all of these seem probabilities. It is quite probable that Serville's type is not in existence, but at any rate the name *acanthocephala* was published subsequent to Burmeister's *phyllacantha,* and from the original description Serville's species seems to be distinct from either of the species here described as new.

Machima scalprum[44] new species
(Text-figs. 12 and 13; pl. XVIII, fig. 32; pl. XIX, fig. 35.)

Differing from *M. phyllacantha* (Burmeister) in the character of the male cerci, which do not taper in the distal half, but are of approximately uniform depth to very close to the apex where they sharply narrow to a ventral subuncinate extremity. Whether *phyllacantha* possesses a meso-proximal process on the male cerci, as does this species and *paranensis,* we do not know, as nothing is said regarding this in the previously published descriptions of that species, or shown in the sole figure available.

From *paranensis* the present species can readily be separated by the somewhat more pronounced process of the vertex, and by the

Machima scalprum new species. ♂ (type). Nova Teutonia, Santa Catarina, Brazil. Fig. 12.—Dorsal view of left cercus. Fig. 13.—Lateral view of left cercus.

Machima paranensis new species. ♂ (type). Upper (Rio) Igassú, Paraná, Brazil. Fig. 14—Dorsal view of left cercus. Fig. 15.—Lateral view of left cercus.

Apolinaria hygracantha (Karsch). ♂, Muzo, Boyacá, Colombia. Fig. 16. —Dorsal view of left cercus. Fig. 17.—Lateral view of left cercus.

Yungasacris grata new genus and species. ♂ (type). Chiñiri, La Paz Dept., Bolivia. Fig. 18.—Dorsal view of left cercus. Fig. 19.—Lateral view of left cercus.

Yungasacris peruviana new genus and species. ♂ (type). Chanchamayo, Junin Province, Peru. Fig. 20.—Dorsal view of left cercus. Fig. 21.—Lateral view of left cercus.

(All greatly enlarged.)

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[43] Hist. Nat. Ins., Orth., p. 425, (1839). [♂; "New Holland" [= Australia].]

[44] I.e., *a cutting instrument,* in allusion to the form of the male cerci.

shorter male cerci, which latter are also more uniformly deeper as seen in profile, have several nodes along the proximal half of their ventro-internal margins and as viewed from the venter have their inbowed distal extremities much less falcate.

Type.—♂; Nova Teutonia,[45] near Correio Ita, Santa Catarina, Brazil. March 16, 1935. (Fritz Plaumann.) [Academy of Natural Sciences of Philadelphia, Type no. 5753.]

Size medium (overall length, 43 mm.); form moderately compressed; surface moderately polished over underlying sculpture or venation structure.

Head with its medio-dorsal length equal to half that of pronotum (as 15 to 30); eyes very prominent and appreciably exserted, globose, almost circular in basal outline; fastigium with its production more compressed and less inflated laterad than in *M. paranensis*, cephalic node of fastigium slightly more prominent than in latter species and more appreciably overhanging the somewhat broader, yet moderately acute, facial fastigium; face slightly broader than in *M. paranensis*, infra-antennal callose lines present but more evident ventrad than dorsad. Antennae with ventral border of scrobes markedly thickened and elevated ventrad, less strongly so mesad against facial fastigium, proximal antennal article relatively stout cylindrical, in length but slightly less than depth of eye (as 30 to 33), more proximal articles distad of second faintly and narrowly thickened distad, incomplete in type.

Pronotum with greatest breadth across metazona equal to five-sixths of the median length (as 25 to 30), sellation of pronotum quite pronounced as viewed in profile, the surface ascending caudad over a broad but low transverse swell of the surface to the general level of the metazona, which is weakly but appreciably concave both longitudinally and transversely; cephalic margin of pronotal dorsum faintly concave mesad, caudal margin of same broadly and evenly arcuate, principal transverse sulcus moderately impressed on dorsum, a second one very weakly marked narrowly caudad of the more evident one, this followed by the low transverse swelling, pattern of callose lines consisting of a medio-longitudinal one, which is obsolete at the depth of the sellation, evident but low briefly cephalad and over the transverse swelling and more distinct but narrower across the metazonal disk, a pair of straight caudad radiating lines on the metazonal disk reaching from the caudal margin of the transverse swelling to the caudal margin of the pronotum briefly caudad of the broadest portion of the metazona, and a cingulate bordering of the entire metazonal caudal margin, in addition to which two short cephalad diverging nearly straight rugae are present between the middle of the transverse swelling and the weak more caudal of the transverse sulci, between which latter immediately cephalad and touching the same at its ends is placed a very short transverse ruga, which latter on its cephalic side margins the above-mentioned sulcus; lateral lobes with their dorsal length caudad to humeral sinus equal to but three-fourths of the depth of the lobes ventrad of the latter (as 18 to 25), caudal margin of lobes obtuse-angulate, the dorsal section straight oblique to the deepest point of the nearly rectangulate (tegminal) sinus, ventral margin obliquely arcuate ascendant cephalad, rounding cephalad into the subvertical cephalic margin and caudad into the caudal one, surface of lobes appreciably impressed by the cephalic transverse sulcus, which passes without interruption to the pronotal dorsum, caudal transverse sulcus similarly uninterrupted at the usual position of lateral angles of the pronotal disk, the two arcuately connected at the ventral third of the lobes by a raised subvertical ruga which is broadest ventrad, while a short oblique ascending ruga extends from near ventral point of caudal transverse sulcus, surface of lobes within cingulate caudal margin immediately ventrad of humeral sinus shallowly but appreciably and rather broadly impressed.

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[45] This locality is near the Rio Irany, a north side tributary of the Rio Uruguay, with its approximate position 52° 22′ W., 27° 5′ S. Correio Ita is on the Rio Uruguay.

Tegmina surpassing the apices of the caudal femora by a distance subequal to the greatest breadth of the tegmina at their distal expansion, the latter point being proximad of the tegminal apices a distance equal to five-sixths of the pronotal length (as 25 to 30), the greatest breadth at the sutural expansion being 1.4 times the pronotal length (as 42 to 30), the tegminal breadth at the narrowest point (at distal third) equal to six-sevenths that at greatest expansion (as 36 to 42); costal margin low arcuate throughout, sutural margin straight from apex of stridulating field to distal third, then concavely widening to the very narrowly rounded apex of the rectangulate expansion, distal section of margin shallowly concave oblique-truncate to the narrowly rounded rectangulate tegminal apex, which is costal in position; humeral trunk appreciably but not strongly sinuate, secondary anastomosing cross-nervures relatively strong and coarse, with little difference in emphasis or thickness of the numerous components, no appreciable development of areolar boundaries and no subsidiary areolets as in *Machimoides*, stridulating field with its greatest breadth slightly greater than half its length (as 33 to 60), stridulating vein relatively strong, its distal node well marked. Wings with normally exposed portion surpassing the tegmina by a distance but faintly less than the breadth of the distal tegminal expansion (as 42 to 44), narrow, its apex acute and sutural margin straight.

Mesosternum and metasternum with the lateral lobations broadly arcuate marginally.

Abdominal tergites with the color pattern not defined by surface rugae or callosities as in *Machimoides*, instead relatively smooth; ultimate tergite very strongly transverse, shallow, its median length little more than one-sixth of its greatest breadth (as 6 to 23), distal margin broadly and shallowly concave-emarginate laterad about cercal bases, the greater (median) portion of the margin between very slight supra-cercal subobtuse points is broadly and very shallowly concave, no marked surface sculpture; supra-anal plate in general trigonal, as long as proximal breadth, disto-laterad and distad with a raised margin, which in life may be at least partially membranous, as in the dried type it is irregularly thickened, surface of distal two-thirds of plate appreciably concavo-excavate; cerci greatly elongate, their length in lateral view, but not following their curvature, equal to 1.3 times the length of the pronotal disk, roughly forcipate, in profile with a short subcylindrical peduncular base from which springs mesad a trigonal deplanate process, which is subfalciform distad but with its immediate apex, as seen in distal aspect, slightly flattened, broadened and rounded; its margin supplied with a series of numerous short and relatively blunt denticles, shaft of cerci distad of the peduncular base and this internal process directed distad as a compressed forcipate structure, which in profile is nearly uniform in depth although slightly deeper mesad and both the dorsal and ventral margins are faintly sigmoid, the greatest depth nearly equal to a sixth the straight line length of the entire cercus (as 20 to 125), dorsal border sharply subcultriform, ventral surface for about two-fifths of the length distad of the marked internal process subdeplanate, narrowing distad, on the external side rounding into the lateral face, on the internal side sublamellately cultriform, with two spaced marginal low subcircular nodes, distad of the more distal of which the ventral surface is sharply longitudinally concave for the remainder of the length distad, the internal border of the concavity more sharply cingulate than the external, as seen from the dorsum the general curvature of the cercus is moderately sigmoid forcipate, inbowing moderately a short distance distad of the proximal process, then outbowed and finally subfalciform distad, with the apices crossing, distal extremity (i.e., distal fifth) as seen in profile sharply narrowed by concave excision of dorsal border, thus making the actual apex a narrow acute subfalciform point, by spiral torsion the plane of the normal external surface becoming at the apex the ventral face and the extreme apex appreciably upcurved; subgenital plate with prestylar ridges of ventral surface diverging proximad to the latero-proximal bases, a short fine medio-longitudinal carinula present on the ventral surface from the bottom of the distal emargination to a medio-proximal membranous section of the plate, median incision of the distal margin narrowly and deeply acute-angulate emarginate, nearly twice as deep as the external length of one of the styles, the latter relatively stout, subdepressed, short, and not quite as long as the distance across the emargination between their bases, their apices bluntly rounded.

Cephalic femora but slightly longer than greatest pronotal length (as 33 to 30), moderately compressed, the depth equal to two-elevenths of the length, nearly straight, internal (cephalic) genicular spine equal in length to the greatest thickness of the femur as seen from dorsum, external (caudal) genicular spine relatively minute, ventro-internal (ventro-cephalic) margin with a single spinule at distal fourth, remainder of both ventral margins unarmed; cephalic tibiae with length somewhat greater than that of femora (as 44 to 33), dorsal (extensor) margins unspined. Median femora equal in length to 1.4 times that of the cephalic femora (as 47 to 33), slightly more slender and more compressed than the cephalic ones, the subequal depth not over one-ninth of the length (as 5 to 47), in profile nearly straight, external (cephalic) genicular spine slightly greater in length than median thickness of femur as seen from dorsum (as 4 to 3), internal (caudal) genicular spine no longer in proportion than the external (caudal) one of the cephalic femora, ventral (flexor) margins as in cephalic femora; median tibiae 1.15 times as long as the femora (as 54 to 47), dorsal (extensor) margins with 1–2 spinules in proximal two-fifths. Caudal femora failing to reach the tegminal apices by a distance equal to 1.5 times the pronotal length, their total length nearly equal to two-thirds that of the tegmina (as 135 to 208), slender in distal half, very moderately and evenly inflated dorsad in proximal half, ventral (flexor) margins straight, as seen from dorsum the whole femur is distinctly compressed in proximal third, both genicular lobes spinosely produced, these structures tapering, the external slightly longer than the internal, both ventral (flexor) margins with spaced, falcately curved, proximally sublobiform and distally acuminate spines, these numbering six on the external and four on the internal margin, the distal three on each margin much surpassing in length those more proximad; caudal tibiae 1.2 times as long as the femora (as 162 to 135), slender, the extensor margins with spaced falcately curved, proximally sublobiform and distally acuminate spines like those of the ventral (flexor) femoral margins, these regularly decreasing in length distad in the distal half to a size no greater than that of the 4–8 spaced spinules found on the margins of the flexor surface, external margin with 8, internal with 12.

Coloration.—Base color between reed yellow and colonial buff (of Ridgway),[46] with the chief overlying dark pattern mummy brown to blackish fuscous. Head with occiput bearing a cephalad narrowing pair of cinnamon-brown lineations which reach to the process of the vertex, face slightly washed with the same mesad; eyes buckthorn brown, paucilineate with darker; antennal scrobes ticked with blackish fuscous, two proximal antennal articles brevilineate with same, remainder of antennae with widely spaced rather broad dark annuli, pale areas sometimes washed with russet. Pronotum strongly maculate with the dark pattern, this involving most of the metazonal disk aside from the pale callose lines, the two diverging cariniform areas on the transverse discal swelling, the greater part of the cephalic border of the disk and several maculae mesad on each lateral lobe and a single one in the usual position of lateral carinae. Tegmina with the blackish fuscous blotching well spaced but more emphasized nearest the costal and sutural margins and apex, these not solid but broken up into numerous components by the pale anastomosing veinlets (see pl. XVIII, fig. 32; pl. XIX, fig. 35), stridulating field with a number of blackish fuscous maculae. Exposed portion of wings colored as the tegmina. Pleura with numerous blackish fuscous maculae. Cephalic coxae pale, median ones with a single ventro-proximal dark dot, caudal ones heavily infuscate ventrad and mesad. Abdomen as a whole relatively paler proximad, distad becoming progressively sexlineate, three on each side, plus a similar narrow distal edging of the tergites and on

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[46] This was probably more greenish in life.

each of the more distal tergites a less complete, sinuately oblique pale bar between the two more lateral straight major pale bars, all of these made by the pale base color there being clear and demarcated by a suffusion of the intermediate areas of the tergites with washed-out linings or cloudings of brazil red (of Ridgway), which on the more distal of the segments so patterned is reenforced by a caudal intra-marginal bar of fuscous. Supra-anal plate with its depressed section fuscous; cerci marked with fuscous ventro-laterad and dorsad at the extreme apex; subgenital plate quadrilineate with fuscous, these bordering the raised prestylar ridges on each side, the internal pair broadening proximad to cover nearly all of the ventro-proximal portion of the plate. Cephalic and median femora blotched in distal half, and chiefly on the cephalic face, with fuscous; cephalic tibiae similarly clouded about tympanum and narrowly so distad, median tibiae narrowly fuscous distad; caudal femora blotched, clouded and incompletely annulate with fuscous, maculae of proximo-dorsal section consisting of subcircular spots, marginal spines dark with pale proximal edgings; caudal tibiae with numerous small maculae, chiefly proximad, spines less solidly dark than on femora; all tarsi infuscate on each lateral face.

Measurements.—Overall length, 43 mm.; length of body (exclusive of cerci), 21; length of pronotum, 4.9; length of tegment, 33.9; greatest breadth of tegmen at distal expansion, 7.1; length of wings distad of tegmina, 6.8; length of cephalic femur, 5.3; length of caudal femur, 22.

The type of this very distinctive species is unique.

Machima paranensis[47] new species (Text-figs. 14 and 15.)

This species is very closely related to *M. scalprum,* and differs chiefly in the characters given in the preceding key to the species of the genus, and in the diagnosis of *M. scalprum.*

Type.—♂; Upper (Rio) Iguassú, Paraná, Brazil. 1901. (E. R. Wagner.) [Academy of Natural Sciences of Philadelphia, Type no. 5754.]

As this species is very closely related to *M. scalprum,* described on the preceding pages, the following description is entirely comparative with that of the latter species, and it is to be understood that in other features the two are in virtual agreement.

Size and general form essentially as in *scalprum* except that the caudal femora are somewhat shorter.

Head with production of fastigium blunter than in *scalprum,* its dorsal point lower and less compressed, in profile rounded rectangulate, cephalic node of fastigium less prominent than in *scalprum,* facial fastigium somewhat narrower than in *scalprum.*

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[47] From the state of Paraná.

Pronotum slightly shorter and proportionately somewhat broader than in *scalprum*, the greatest breadth across the metazona of the disk being but slightly less than the median length (as 24 to 25), the more caudal of the transverse sulci on the dorsum is even less marked than in *scalprum*, and in consequence subobsolete, although evident on the lateral lobes.

Tegmina very similar to those of *scalprum* but faintly narrower, which is reflected in a somewhat less ample distal expansion and slightly narrower marginal, discoidal and stridulating fields, while the speculum of the latter area is narrower and more sharply angulate proximad and distad. Normally exposed portion of the wings as in *scalprum*.

Ultimate abdominal tergite as in *scalprum*, details of supra-anal plate not ascertainable in unique type (due to retraction of plate); cerci in lateral view, but not following their curvature, equal to 1.8 times the length of pronotal disk, equally forcipate as in *scalprum* and with the general configuration similar, but with differences in details, trigonal proximo-internal process the same in outline, size and curvature but with its apex slightly thinner and less expanded transversely, shaft of cercus moderately but appreciably shallower, the greatest depth not over an eighth of the straight line length of the entire cercus (as 5.5 to 45), subequal in depth in proximal half, gently narrowing thence distad, in profile hardly sigmoid, dorsal margin of shaft as cultriform as in *scalprum*, ventral surface from proximo-internal process distad to apical area narrowly but distinctly sulcate, the external edge a rounded cingulum, the internal one a cultriform border, no distinct surface nodes present, as seen in dorsal aspect the proximal three-fifths of the shaft of the cerci are nearly straight, slightly diverging, while the distal two-fifths are strongly and fully recurved falcate, lapping one over the other for a fair distance, distal extremities of the cerci as in *scalprum* but slightly less sharply falciform; subgenital plate as in *scalprum* but distal emargination narrower, more slit-like, and styles longer and more slender, the length of the latter much greater than the distance between their bases and subequal to the depth of the median fissation.

Cephalic femora appreciably longer than the greatest pronotal length (as 32 to 25), but proportions otherwise as in *scalprum*, external (caudal) genicular spine rudimentary, ventro-internal (ventro-cephalic) margin with 1–2 spinules in distal half; cephalic tibiae with ratio of length to that of femora as in *scalprum*, dorso-internal (dorso-cephalic) margin may or may not have a single spine at the distal end of the tympanum. Median tibiae with both extensor (dorsal) margins having a single spine at proximal two-fifths of their length. Caudal femora somewhat shorter than in *scalprum*, failing to reach tegminal apices by a distance equal to 1.8 times the dorsal length of the pronotum (as 45 to 25), their total length equal to approximately two-thirds that of the tegmina (as 137 to 203), ventral (flexor) margins with sublobate spines as in *scalprum*, the external margin with 6–7, internal with 4–5; caudal tibiae 1.12 times the length of the femora (as 162 to 137), spined as in *scalprum*, but longer spines slightly more attenuate.

Measurements.—Overall length (including alar organs), 42.8 mm.; length of body (exclusive of cerci), 17.5; length of pronotum, 4; length of tegmen, 33; greatest breadth of tegmen at distal expansion, 5.7; length of wings distad of tegmina, 6.8; length of cephalic femur, 5.2; length of caudal femur, 22.3.

Coloration.—Pattern essentially as in *M. scalprum,* color tones apparently altered by immersion in preservative at time of collection, and hence pale base color is chamois to cinnamon-buff, probably definitely more greenish in its natural condition. The dark pattern has not been altered materially and now ranges in tone from prout's brown to fuscous, the former only distad on alar organs. The sole noteworthy differences from the dark pattern of *scalprum* are: the occiput is unmarked, and the dorsum of the pronotum has less of the infuscation, which is absent from the cephalic margin and much less extensive on the metazonal disk, evident only as masses laterad of the pale radiating lines and as narrow lateral borderings to the median pale line.

The type of this species is unique.

APOLINARIA[48] new genus

1896. *Machima* Karsch, Entom. Nachrichten, XXII, p. 346. (Not of Brunner, 1878.)

This very distinctive genus can readily be distinguished from the related genera here treated by having the genicular lobes of all the femora markedly elongate, spinose and rod-like, and all the femora possess on their flexor margins, and all of the tibiae on their extensor ones, greatly elongate, compressed and proximally sublobate spines, while the tegmina have the marginal field uniformly broad and not subobsolete in distal half. In addition the relatively short and broad tegmina, the relatively short and rectangulate male cerci and the markedly laterad expanded metazonal disk of the pronotum are particular characteristics. The subcultriform process of the vertex suggests *Machimoides,* but the caudal femoral spination is nearer that of *Machima,* which is also more nearly approached in the genicular development, yet the male cerci are widely different from those found in either of these genera, and the lobate spinations of the cephalic and median limbs are found in none of the relatives.

Generic characters.—Form of medium length, subcompressed. Vertex with a subcultriform compressed process, extending dorso-cephalad, narrowing distad, apex vertically concavo-truncate; relatively small and low paired ocelli placed at the ventro-cephalic base of process; face with markedly developed paired infra-antennal and infra-ocular raised linear callosities; eyes prominent, globose; antennae surpassing body and tegmina in length, proximal article slightly less than twice as long as the second one. Pronotum sellate, but with dorsum of metazona much expanded transversely, the breadth of same slightly greater than pronotal length, disk with a pattern of raised callose lines, consisting principally of a medio-longitudinal one, another encircling the entire margins, involving equally the periphery of the lateral lobes, a subchevron-shaped one mesad, this descending laterad over much of the lateral lobes, one on the humeral angle caudad of the transverse figure, an accessory caudad arcuately diverging pair laterad on the metazonal disk, and a sublongitudinal one caudad on the lateral lobes; lateral lobes somewhat longer than deep, roughly semicircular in outline, humeral (tegminal) sinus broad but shallow, arcuately emarginate. Tegmina surpassing apex of abdomen by approximately the combined length of head and pronotum, equalling but not surpassing the apices of the caudal femora, relatively broad, ovate, the greatest breadth nearly equal to two-fifths of the tegminal length, a marked acute-angulate expansion present at the junction of the sutural and the concave distal margin, costal margin distad rounding into distal margin; marginal field broad and subuniform in width to the tegminal apex, stridulating field relatively short and broad, its free margin evenly rounded without any evident lobation at extremity of stridulating vein; humeral trunk weakly sinuate, submedian in position and in no way approaching the costal margin, mediastine vein very short and weak, median vein with its main ramus reaching to apex of disto-sutural production of margin, stridulating vein relatively weak, speculum poorly defined; major cross-veins developed as in *Machimoides*, oblique in marginal field, forming roughly subquadrate to subrectangulate areolae in the discoidal field, the multiple areolets of the same generally of the finely anastomosing cribrose type described for *Machimoides*. Wings surpassing the tegminal apices by less than the pronotal length, apex acute, venation of normally exposed section similar to that of tegmina. Prosternum unarmed and non-lobate; mesosternum and metasternum with arcuate lobations laterad. Ultimate abdominal tergite very narrow longitudinally, strongly transverse, distal margin very weakly obtuse-angulate mesad; cerci short, stout, conic and with their surface papillose proximad, the shaft at middle abruptly bent dorsad at a right angle, thence distad compressed, the margins of this section weakly converging distad, the apex rounded with a weak and small terminal nib or point, internal surface mesad with a dorsad-directed accessory digitiform process, the apex of which is subacute; subgenital plate moderately attenuate and appreciably constricted preapically, distal margin rectangulate emarginate, styles short and rather stout, subdepressed, blunt, ventral surface of plate with the prestylar rounded ridges marked, a medio-longitudinal acute but low sublamellate carination present. All femoral genicular lobes greatly developed, rod-like, spinose; ventro-cephalic

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[48] In honor of Hermano Apolinar Maria, of the Instituto de la Sallé, Bogotá, Colombia, distinguished Colombian naturalist, to whose interest, industry and learning we owe much of our present knowledge of the natural history of his country.

(ventro-internal) margin of cephalic femora and both ventral margins of the median and caudal pairs supplied with greatly elongate sublobiform spines, these aciculate and generally curved distad, ventro-caudal margin of cephalic and median tibiae supplied with similar sublobiform spines[49] as well as both dorsal (extensor) margins of caudal tibiae, ventral (flexor) margin of caudal tibiae with a few very short spines distad.

GENOTYPE: *Apolinaria hygracantha* (Karsch) [*Machima hygracantha* Karsch].

Distribution.—Colombia. The sole exact locality from which the species is known is in the western foothills of the Cordillera Oriental.

But a single species is known of this remarkably formed genus, which in appearance is one of the most distinctive of the entire Phaneropterinae.

Apolinaria hygracantha (Karsch)
(Text-figs. 16 and 17; pl. XIX, figs. 36 and 37)

1896. *Machima hygracantha* Karsch, Entom. Nachrichten, XXII, p. 346. [♂; Colombia.]

There is before me a single male of this species, which is here figured for the first time, from Muzo, Boyacá, Colombia, taken in 1922, and received from Hermano Apolinar Maria. This individual fully agrees with Karsch's description except for trifling differences in the number of spines on certain limb margins. Its measurements are very similar to the few given by Karsch, but to aid future workers the principal dimensions of the Muzo individual are as follows: overall length, 32.9 mm.; length of body, 20; length of pronotum, 5.2; greatest breadth of metazonal disk, 6; length of tegmen, 21.2; median breadth of tegmen, 7.4; greatest breadth of tegmen at apex of sutural marginal projection, 10.9; length of wings distad of tegmen, 4; length of cephalic femur, 7.6; length of caudal femur, 20.3.

Muzo is the only exact locality from which the species has been recorded, and is situated in the western foothills of the Cordillera Oriental, the surrounding elevations ranging from about 1950 to 4000 feet above sea-level. Whether the species is one limited to these elevations of the western slopes of the Cordillera Oriental, or is an intrusive from the Magdalena River forest of lower levels to the west, remains to be determined.

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[49] From a casual examination these structures would seem to be median in position, but they are developments of the caudal margin, and the corresponding cephalic one is separated by a fine median sulcus and is unarmed.

YUNGASACRIS[50] new genus

As shown in the key to the genera this striking genus is well removed from any of its allies, and stands in the same relation to the genera with specialized caudal femoral and tibial marginal spination, that *Quiva* does to those of the section which lack such distinctive features. It lacks specialized head and pronotal structures, its tegmina show but a trace of the usual distal preapical expansion, its compressed cephalic and median limbs are unusual, the caudal femora show an infrequent feature in that they taper in depth proximad from their deepest point, while the lamellate expansion of one of their ventral spines suggests *Paraphidnia* and *Dysonia*, and finally the caudal tibiae are distinctive in having a closely placed group of two to three lamellate spines proximad on both extensor margins. In the aggregate of its features and in its ensemble *Yungasacris* connects the *Machima* pole of the group with the opposite one represented by *Dysonia*.

Generic features.—Form elongate, subcompressed, fully alate. Vertex bluntly produced into a nodose non-cultriform non-lamellate structure, its distal outline well rounded in profile; face with low subvertical linear callosities of variable emphasis and completeness; eyes prominent, somewhat exserted, globose; antennae elongate, setaceous distad of second article, which latter is not more than half the length of the stouter subcylindrical proximal one. Pronotum sellate, greatest breadth across metazona little more than median length, surface without distinct pattern of callose lines; lateral lobes with humeral (tegminal) sinus rectangulate. Tegmina surpassing apex of abdomen by more than half (male) or nearly half (female) their length, elongate lanceolate in outline, narrowing slightly in distal half except for a very moderate preapical expansion of the sutural margin, distal (apical) margin oblique truncate; venation of tegmina, including anastomosing areolets, conspicuous and largely irregular in the shape of the many units. Wings with distal extremity surpassing apex of closed tegmina by a distance approximately equal to the combined length of the head and pronotum. Prosternum unarmed and non-lobate; mesosternum and metasternum with arcuate lobations laterad. Ultimate abdominal tergite very short, strongly transverse, its distal margin truncate (♂) or weakly arcuate (♀); supra-anal plate of ♂ and ♀ semi-elliptical in outline; cerci of ♂ with a stout peduncle followed by an elongate compressed subcultriform shaft, with a trigonal deplanate process on mesal side at junction of the peduncle and shaft, dorsal surface of process and adjacent shaft markedly concave-excavate; subgenital plate of ♂ broad proximad, narrowing disto-mesad to a short process which is emarginate distad and bears short articulate styles; cerci of ♀ styliform, tapering, simple, very slender distad; ovipositor with its greatest length equal to twice that of pronotal dorsum, falcate, in greater part of uniform depth, dorsal and ventral margins serrulate in distal section, apex narrowly rounded, lateral surfaces distad with numerous raised spicules; subgenital plate of ♀ elongate trigonal in outline, inverted tectate in cross section. Cephalic and median limbs short, moderately compressed, femora with cephalic genicular lobe at most but brevispinulose, caudal one on same unspined and rounded, femoral ventral margins strongly carinate, cephalic margin of each with one or more spines distad, caudal margins unspined. Caudal femora reaching to three-fifths (♂) or two-thirds (♀) of the tegminal length, slender, bullation greatest at two-fifths of their length, the depth regularly decreasing thence proximad, distal two-fifths slender, both genicular lobes brevispinose, ventral carinae with spaced spines, of which a preapical one on each margin is acute and alately lamellate, sculpture of external face of expanded portion of caudal femora made up of numerous subvertical and parallel regulae; caudal tibiae slightly longer than the femora, spination of dorsal (extensor) margins with the more proximal elements sublamellate, a closely placed group of 2–3 such spines present on the proximal fifth of both dorsal (extensor) margins.

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[50] In allusion to the Yungas, a regional name applied to portions of the eastern Andean slopes in Bolivia.

GENOTYPE: *Yungasacris grata* new species.

Distribution.—The lower eastern slopes of the Andes in central Peru and northwestern Bolivia.

Remarks.—The two species of the genus here described are closely related and may be found to be complementary geographic forms of a single species which intergrade in the intervening territory, hence subspecies and not full species. However, until this has been established the better course is to regard them as distinct species.

Key to Species of Yungasacris

1. Stridulating field of male tegmina somewhat wider, with stridulating vein more elongate. Cerci of male somewhat shorter (see text-fig. 19), with distal attenuation broader as viewed in ventro-lateral aspect, external subvertical dorsal marginal lamellation at proximal third less ampliate dorsad, ventro-internal process directed distad, the concave excavation at its dorsal base less sharply marked off from the peduncle of the cercus; subgenital plate of male relatively shorter, its distal emargination more shallow, styles less robust. (Bolivia.) .....**grata** new species

Stridulating field of male tegmina somewhat narrower, with the stridulating vein shorter. Cerci of male more elongate (see text-fig. 21), with distal attenuation narrower as viewed in ventro-lateral aspect, external subvertical dorsal marginal lamellation at proximal third more ampliate, ventro-internal process directed mesad, the concave excavation at its dorsal base more sharply marked off from the peduncle of the cercus; subgenital plate of male relatively longer, its distal emargination deeper, styles robust though short. (Peru.) .... **peruviana** new species

Yungasacris grata[51] new species
(Text-figs. 18 and 19; pl. XVIII, fig. 33; pl. XIX, fig. 34.)

The more evident characters separating this species from *Y. peruviana,* also here described, have been given in the preceding key to the species of the genus. In addition the anastomosing pattern of the minor nervures of the tegmina is coarser and less intricate than in *Y. peruviana.*

Type.—♂; Chiñiri, Rio Kaka, La Paz Department, Bolivia.[52] Elevation, 1125 feet. September 3, 1934. (M. A. Carriker, Jr.) [Academy of Natural Sciences of Philadelphia, Type no. 5758.]

Size larger than average for the group (overall length, 54 mm.); form moderately compressed, elongate, surface moderately polished.

Head with its greatest dorsal length not more than half the greatest breadth across eyes; vertex rounded conic in both dorsal and lateral aspects, its dorsal outline evenly continuous with the occipital profile, ventro-cephalad it is developed into a slightly projecting subcircular fastigial node, which is almost contiguous with the fastigium of the face, which latter has its surface flat, subacute in outline dorsad and with its dorsal apex narrowly rounded; face with its breadth at half the depth equal to nearly two-thirds the breadth across the eyes, with a pair of relatively continuous subvertical but sinuate infra-ocular callose ridges and an incomplete ventral pair of more median position, which latter are incurved and coalesce ventrad with the infra-ocular pair and dorsad become obsolete on the middle of the face, latter is transversely and shallowly concave at half of its depth and also at its ventral border; antennae probably reaching to the tegminal apices.[53]

Pronotum with greatest median length but very slightly greater than the maximum breadth of the metazona of the disk (as 105 to 101), sellate form marked in the prozonal section, the disk of the metazona deplanate both longitudinally and transversely; cephalic margin of disk subtruncate, caudal margin of disk broadly arcuate, more strongly curved laterad than mesad, somewhat incurving latero-cephalad to the humeral (tegminal) sinuses, surface of disk with a transverse non-sulcate depression at lowest point of sellation, followed by an obtuse-angulate broadly V-shaped, laterad obsolete transverse sulcus, and a short narrow medio-longitudinal impression, extending cephalad from the metazona and ending in a transverse subtrigonal impression which is cradled within the angulation of the sulcus and is sharply delimited cephalad by a very low swelling of the adjacent surface, metazona of disk cut off from the more cephalic section of the disk by a transverse subarcuate rather broad impression, which reaches laterad almost to the lateral borders of the metazonal disk; lateral lobes of the pronotum with their greatest length (at middle of their depth) contained nearly 1.2 times in their depth ventrad of the humeral sinus (as 72 to 85), their surface mesad with a low but distinct callose area which is divided obliquely into three parts by low impressions.

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[51] I.e., *pleasing,* in allusion to the color pattern of the species.

[52] This locality is situated at the junction of the Rio Mapiri and the Rio Kaka, upper tributaries of the Rio Beni. It is about 27 miles (air-line) ESE of the better known settlement of Mapiri, and its approximate position is 15° 18′ S., 67° 45′ W.

[53] While manifestly incomplete in the type and allotype, in the former they fall short of the tegminal apices by no more than the pronotal length.

Tegmina surpassing the apices of the caudal femora by slightly more than twice the pronotal length, breadth at preapical very weakly marked expansion equal to approximately four-fifths the tegminal breadth at the apex of the stridulating field; costal margin moderately arcuate in proximal half, straight thence to the narrow rounding into the oblique subtruncate distal margin, sutural margin distad of stridulating field very faintly concave; marginal field relatively broad, stridulating field with its greatest breadth equal to two-fifths of its maximum (from articular base) length; humeral trunk with its elements subsigmoid in proximal two-fifths, then from an appreciable angle straight to the apical branching, venation of the discoidal field as usual in the group; stridulating vein well developed, tapering in width toward both extremities but more gradually toward sutural one, maximum length of stridulating vein subequal to the greatest breadth of the metazonal disk of the pronotum, tympanum of the stridulating field elongate subtrigonal in form, its greatest breadth at proximal third of its length and contained 1.3 times in the latter. Normally exposed portion of wings equal in length to 1.3 times that of the disk of the pronotum (as 47 to 36), the extremity of the costal margin rounding to the acute apex, the apparent sutural margin straight, venational anastomosing of the normally exposed portion of the wings similar to that of the distal portion of the tegmina.

Mesosternum with the arcuation of the free margins of its lobes more strongly convex than those of the metasternal lobes, which latter, while longer, are somewhat lower in their curvature.

Ultimate abdominal tergite very short, strongly transverse, its length to greatest breadth as 11 to 75, the distal margin very shallowly concave about external bases of cerci; cerci in lateral view with their greatest length nearly seven-eighths as long as the medio-dorsal length of the pronotum (as 85 to 103), peduncle short and stout, with many setigerous tubercles, shaft obliquely inclined disto-dorsad as seen in profile and with its general form subsigmoid in same view, with juxta-peduncular depth equal to that of peduncle in profile, the proximal half of the length of its ventral outline straight, the dorsal outline arcuately decurving distad to a point at the middle, where the depth is hardly more than half that at the peduncle shaft juncture, in profile the distal extremity of the cerci is slightly narrowed to the apex, which is strongly arcuate on the ventral side to a falcate claw-like tip at the dorsal margin, which latter is relatively straight distad, as seen from the dorsum the cerci are moderately inbent from the middle of the shaft, which more proximad, and including the internal side of the trigonal process, is definitely lamellate compressed dorsad, deeply concave-excavate from near its middle proximad to the peduncle, which is stout and circular in cross-section, as seen from venter the outline of the trigonal process, which is developed from the internal surface of the shaft at the peduncular juncture, is acute-trigonal, slightly longer at its base than the breadth of its roughly transverse truncate distal border and with its internal apex moderately acute, lamellate and subdecurved, ventral surface of proximal three-fifths of shaft appreciably concave, particularly distad, within marked cingulate lateral margins, distal two-fifths of cerci compressed, lamellate and with dorsal and ventral margins subcultriform; subgenital plate with greatest proximal breadth slightly less than length of plate to base of styles (as 50 to 55), dorso-lateral margins evident and sublamellate in proximal two-thirds, straight as seen in profile, prestylar ridges distinct but rounded transversely, parallel in distal third, thence proximad arcuately diverging to lateral bases of plate, medio-longitudinal section of venter of plate moderately elevated, distal margin between styles broadly but rather shallowly U-emarginate, styles short and blunt, their length definitely less than the interval between their bases.

Cephalic femora about five-sixths as long as the pronotal dorsum (as 31 to 36), greatest depth equal to one-fourth of their length, the greatest thickness to one-half of the depth, dorsal outline moderately arcuate, ventral ones virtually straight, the ventro-cephalic (ventro-internal) with one or two oblique spines in distal half, cephalic (internal) genicular spine very short;[54] cephalic tibiae 1.3 times as long as the cephalic femora, appreciably compressed throughout, post-tympanal dorsal section very shallowly sublamellate, the cephalic (internal) carina indicated subobsoletely proximad, lacking proximad, the closely placed caudal (external) one continuous and marginal, neither spined.[55] Median femora approximately 1.3 times as long as the cephalic ones (as 25 to 18), of subequal depth, this being equal to approximately one-fifth of the length, dorsal and ventral margins virtually straight, as seen from dorsum the greatest (distal) thickness is equal to three-fifths of the depth, in same view the median femora are seen to be incurving to base in proximal half, ventro-cephalic (ventro-external) margin with one or two spines in distal half similar to those of the same margin of the cephalic femora, cephalic (external) genicular spine even shorter and less evident than that on the same side of the cephalic femora; median tibiae in length equal to one and one-sixth times that of the median femora, moderately compressed, narrow dorsal surface longitudinally sulcate, the dorso-caudal (dorso-internal) margin well carinate, unarmed,[56] dorso-cephalic (dorso-external) margin subcarinate only proximad. Caudal femora appreciably longer than the body (minus appendages), the greatest depth, which is at proximal two-fifths of the length, contained nearly nine times in the length (as 17 to 152), the depth appreciably tapering thence proximad, while distad the even but appreciable concavity of the dorsal outline narrows in the distal two-fifths of the femora to a very slender and subequal extremity, ventral margins straight, genicular lobes brevispinose, but longer than any on the other femora, ventro-external (ventro-cephalic) margin at distal third with a single large broad oblique and laterad diverging, proximally lamellate, apically acuminate spine, while the more proximal section of that margin has four spaced oblique spines, these very short proximad but increasing in length distad, all, however, much smaller than those in distad third, ventro-internal (ventro-caudal) margin with similarly placed and formed larger spines, but fewer (2) in the minor more proximal category, ventral surface deeply sulcate, external (lateral) surface with ventral marginal carination bordered dorsad by a complete and marked sulcation, which in turn is delimited dorsad by a linear subcariniform elevation which reaches from near the base of the femur to the base of the genicular lobe, external surface of the more bullate section of the femur dorsad of the lineation with the subvertical subparallel rugulae marked and numerous, broken into dorsal and ventral groups by an incomplete longitudinal connecting ruga; caudal tibiae somewhat longer than the femora (as 162 to 152), slender, very slightly stouter proximad, subquadrate in cross-section, dorsal (extensor) margins each with a series of well-spaced spines which as a whole decrease in length proximad, the larger ones rather broad and subexpanded at their bases, each margin with a group of three very closely placed, moderately long and sublamellate spines in the proximal fifth of their length, internal margin with a considerable unarmed diastema between these and the first of the more regularly placed series, in which interval the external margin has a relatively large spine.

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[54] Present on one side, virtually lacking on the other—probably a teratological condition.

[55] An articulate spur is present at distal extremity of caudal one.

Allotype.—♀; Songo, Bolivia.[57] [Vienna Natural History Museum.]

Differing from the preceding description of the male sex (type) in the following noteworthy respects.

Anal field of the tegmina relatively narrow, its venation coarsely anastomosed. Normally exposed portion of wings equal in length to 1.4 times that of the disk of the pronotum, as a whole this area as seen in profile being slightly narrower than in male.

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[56] *Has an articulate distal spur as the cephalic tibiae.*

[57] *Relative to this locality see footnote 36 under Machimoides yuracare.*

Ultimate abdominal tergite with its distal margin shallowly arcuate produced as seen from dorsum; surface of supra-anal plate with a slightly raised carinula completely paralleling the margin of the plate and thus separating the very shallowly impressed disk of the plate from a narrow marginal border; cerci about one and one-half times as long as the supra-anal plate, straight, quite stout proximad and then tapering rather sharply to aciculate apices; ovipositor equal to faintly more than half the length of the caudal femora, falcate, straighter in proximal half, more evenly arcuate distad, slightly deeper proximad than mesad, evenly narrowing in this section, subequal in depth in distal half, dorsal margin serrulate in distal half, more sharply so at the rounded apex, ventral margin with serrulations covering two-thirds the length of the margin, sharper, recurving distad; subgenital plate elongate trigonal, deeply ridged meso-ventrad.

Coloration.—Pale base color ranging from light ochraceous-buff to cinnamon-buff, palest on the more elevated areas of the face and genae, in the center of the lateral lobes of the pronotum, on the pleura, cephalic and median limbs, as well as areas of the caudal tibiae and in the paler elements of the pattern of the abdominal terga, this tone suffused with the dark shade very largely on the dorsum of the head, pronotum, remainder of the lateral lobes of the latter, and the more impressed areas of the face and genae, the subobsolete transverse annuli of the cephalic and median limbs, general tone of the caudal femora and the darker elements of the abdominal pattern also ranging from cinnamon to tawny. Face with a narrow medio-vertical line of russet (♂), to grayish (♀), elsewhere subobsoletely lined with obscurely contrasted vertical or subvertical bars of the two tones of the face, these extending over the clypeus; eyes ochraceous-tawny, sometimes (♀) obscurely multilineate with darker; antennae with second article finely lineate on extensor (ventral) surface with blackish, from third article distad english red regularly passing to fuscous distad, and with a few widely spaced and narrow annuli of wax yellow. Pronotum with its dorsal aspect slightly paler on the prozona than on the metazona, the latter approaching vinaceous-tawny, arcuate lateral borders of the metazonal disk pencilled with blackish, as is also less distinctly the case with the median impressed prozonal figure, while a very small spot dorsad on the lateral lobes is similarly colored. Tegmina with pale base color translucent chamois color in proximal half, in the ♂ tinged with cinnamon on stridulating field, transverse neuration and much of the fine anastomosing pencilled in creamy white, the dark areas bister to mummy brown, more distal section of tegmina with the greater density of the anastomosing neuration, which is outlined in creamy white, producing a frosted effect to the naked eye. Normally exposed portion of wings colored the same as the distal portion of the tegmina. Abdominal tergites with symmetrical pattern of lighter and darker shades, consisting chiefly of large lateral pale areas which enclose a dark oval to subcircular area on most of the tergites and five pale lines on the more dorsal portion of the same, the more lateral ones diverging caudad. Cephalic and median tibiae tipped with fuscous, the tympanum of the former and a spot immediately distad of it washed with fuscous. Caudal femora largely mikado brown (of Ridgway) distad to distal margin of the paired alate spines, the fine raised pattern of the external surface more or less distinctly washed with creamy white, extremities of femora and of genicular lobes of same, and much of surface of alate spines, fuscous, caudal tibiae with two broad complete annuli of fuscous, one premedian the other postmedian, several small spots of the same at base of the proximal group of three closely placed spines; caudal tarsi in part marked with fuscous. Cerci of ♂ largely fuscous, the base of the shaft and the internal surface of the proximal appendage pale; styles fuscous. Ovipositor of body color, the ventral valve more pinkish, dorsal valve marked mesad on lateral surface and at base with fuscous.

Measurements.—♂ (*type*); length of body, 22.8 mm.; length of pronotum, 5.8; length of tegmen, 40; breadth of tegmen at preapical expansion, 6.5; length of wings distad of tegmen, 7.6; length of caudal femur, 24.7: ♀ (*allotype*); length of body, 29.5 mm. (exclusive of ovipositor); length of pronotum, 5.2; length of tegmen, 36; breadth of tegmen at preapical expansion, 5.7; length of wings distad of tegmen, 7.3; length of caudal femur, 21.7; length of ovipositor, 11.3.

In addition to the type and allotype I have before me a paratypic male, bearing the same data as the allotype, and belonging to the Vienna Museum. This latter individual shows no noteworthy differences from the type. The two localities from which this species is at present known are not distant from one another.

Yungasacris peruviana new species (Text-figs. 20 and 21.)

The preceding key gives the more evident differences of this species from *Y. grata*, the genotype. In addition the areolation of the tegmina is somewhat finer and more intricate distad.

Type.—♂; Chanchamayo,[58] Junin Province, Peru. [Academy of Natural Sciences of Philadelphia, Type no. 5759.]

The following description is comparative with the preceding one of *Y. grata*, and it is to be understood that unless differences are mentioned the features are as already described for *grata*.

Ventro-cephalic fastigial node of vertex somewhat broader and less distinctly compressed; median transverse facial concavity subobsolete when compared with *grata*.

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[58] The term "Chanchamayo" has often been used for the valley of the Rio Chanchamayo between San Ramón and the site of the present settlement of Colonia Perené, in which area are now included a number of settlements, the best known of which is probably La Merced.

Pronotum with cephalic margin of disk shallowly concave.

Tegmina with areolation finer and somewhat more intricate in distal third than in *Y. grata;* stridulating field somewhat narrower than in *grata,* its greatest breadth equal to slightly more than one-third, but less than two-fifths of the greatest length of the field from the articular base (as 37 to 85), stridulating vein shorter and stouter than in *grata,* tympanum narrower and more longitudinal, its greatest breadth at proximal third contained nearly 1.5 times in its greatest length, accessory venation of stridulating field distad of marginal node more numerous and more closely anastomosed than in *grata.*

Cerci with their general construction essentially as in *Y. grata* but with the shaft more elongate, its distal attenuation more decided, this particularly evident in ventro-lateral aspect, external subvertical dorsal marginal lamellation deeper and more ampliate, ventro-internal process more mesad in general direction than in *grata,* its outline somewhat broader and less attenuate than in latter, the excavation of dorsal surface broader, deeper and more clearly and sharply delimited from dorsal surface of peduncle; subgenital plate longer than in *grata,* more produced disto-mesad, sculpture of ventral surface essentially the same, distal margin with median U-emargination much deeper than in *grata,* at least as deep as distal breadth, hence stylar peduncles longer and more evident, styles stouter, although no longer than in *grata.*

Cephalic and median limbs as in *grata,* but the femora of the former pair are straighter dorsad as seen in profile; median femora with three spines on ventro-cephalic (ventro-external) margin, median tibiae with dorsal surface less definitely sulcate longitudinally than in *grata,* carination of dorso-cephalic (dorso-external) margin subobsolete. Caudal femora as in *grata;* caudal tibiae but faintly longer than femora (as 154 to 152), otherwise as in *grata.*

Measurements.—Length of body, 23.4 mm.; length of pronotum, 5.3; length of tegmen, 41.4; breadth of tegmen at preapical expansion, 6.8; length of wings distad of tegmen, —;[59] length of caudal femur, 24.7.

Coloration.—Pattern essentially the same as in *grata* except that the pronotum has almost no trace of dark maculations, while the genitalia are much less infuscate. The tegminal, distal alar and limb pattern is essentially as in *grata.* Apparently by desiccation the pale base color is almost uniformly cinnamon-buff to chamois, with the dark pattern verona brown (of Ridgway) to bister.

The type of *peruviana* is unique.

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[59] Apices of normally exposed portion of wings damaged.

EXPLANATION OF FIGURES

PLATE XVII

Fig. 22.—*Quiva pulchella* new species. ♂ (type). Leonpampa, Peru. Lateral view. (× 1¼.)

Fig. 23.—*Quiva pulchella* new species. ♂ (type). Leonpampa, Peru. Dorsal view. (× 1¼.)

Fig. 24.—*Machimoides vivasi* new genus and species. ♂ (type). San Esteban, Venezuela. Lateral view. (× 1¼.)

Fig. 25.—*Machimoides vivasi* new genus and species. ♂ (type). San Esteban, Venezuela. Dorsal view. (× 1¼.)

Fig. 26.—*Machimoides minarum* new genus and species. ♂ (type). Lassance, Minas Gerais, Brazil. Lateral view. (× 1¼.)

Fig. 27.—*Machimoides minarum* new genus and species. ♂ (type). Lassance, Minas Gerais, Brazil. Dorsal view. (× 1¼.)

PLATE XVIII

Fig. 28.—*Machimoides yuracare* new genus and species. ♂ (type). Songo, Bolivia. Lateral view. (× 2.)

Fig. 29.—*Machimoides yuracare* new genus and species. ♂ (type). Songo, Bolivia. Dorsal view. (× 2.)

Fig. 30.—*Machimoides yuracare* new genus and species. ♀ (allotype). Songo, Bolivia. Lateral view. (× 2.)

Fig. 31.—*Machimoides yuracare* new genus and species. ♀ (allotype). Songo, Bolivia. Dorsal view. (× 2.)

Fig. 32.—*Machima scalprum* new species. ♂ (type). Nova Teutonia, Santa Catarina, Brazil. Dorsal view. (× 1¼.)

Fig. 33.—*Yungasacris grata* new genus and species. ♂ (type). Chiñiri, Rio Kaka, Bolivia. Dorsal view. (× 1¼.)

PLATE XIX

Fig. 34.—*Yungasacris grata* new genus and species. ♂ (type). Chiñiri, Rio Kaka, Bolivia. Lateral view. (× 1¼.)

Fig. 35.—*Machima scalprum* new species. ♂ (type). Nova Teutonia, Santa Catarina, Brazil. Lateral view. (× 1¼.)

Fig. 36.—*Apolinaria hygracantha* (Karsch). ♂. Muzo, Boyacá, Colombia. Lateral view. (× 1¼.)

Fig. 37.—*Apolinaria hygracantha* (Karsch). ♂. Muzo, Boyacá, Colombia. Dorsal view. (× 1¼.)

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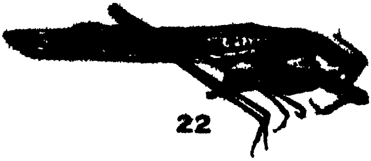

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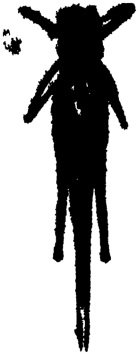

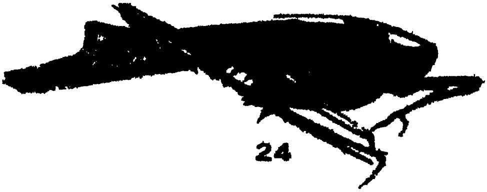

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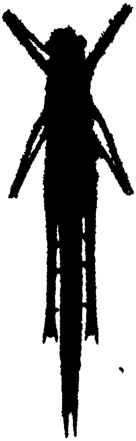

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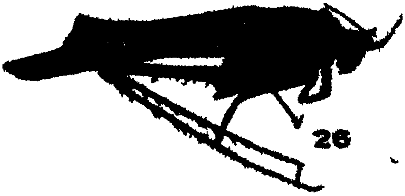

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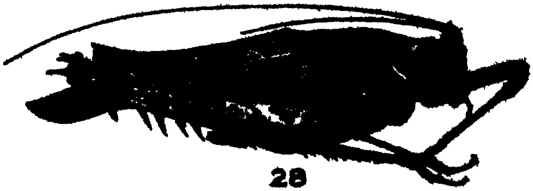
REHN—GROUP DYSONIAE



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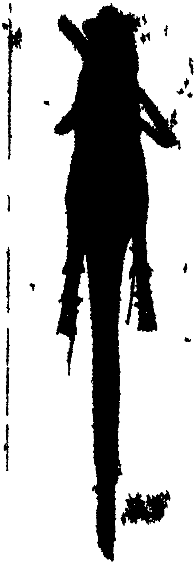

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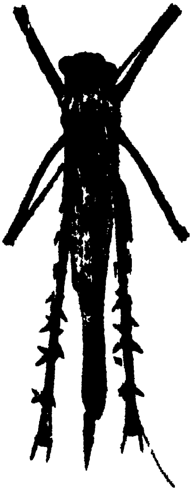

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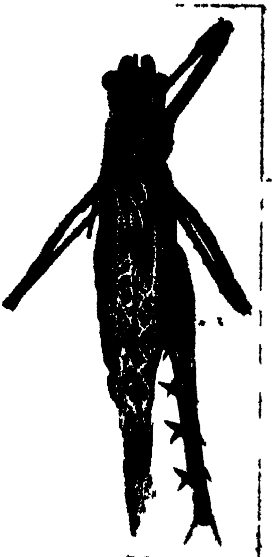

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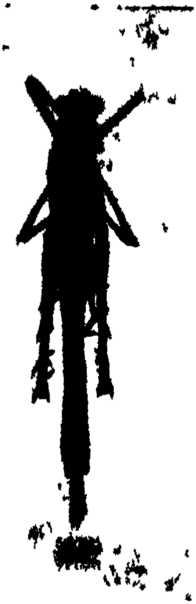

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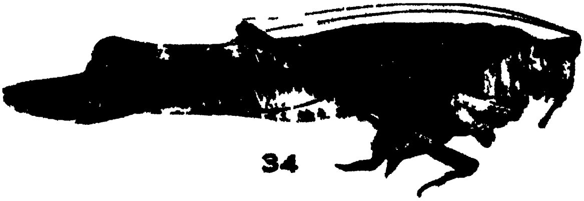

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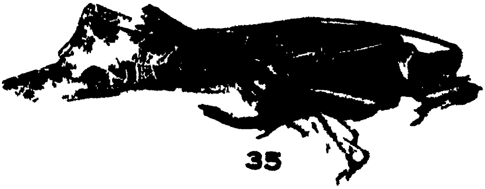

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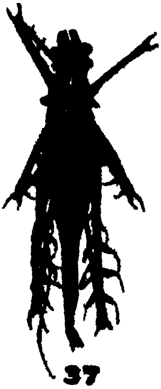

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